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United States
Environmental
Protection Agency

Region V
230 South Dearborn
Chicago, Illinois 60604

Water Division

November 1978

EPA

# Environmental Impact Statement

Draft

COMPLETED

ORIGINAL

## Huron Valley Wastewater Control System

## Wayne County Michigan

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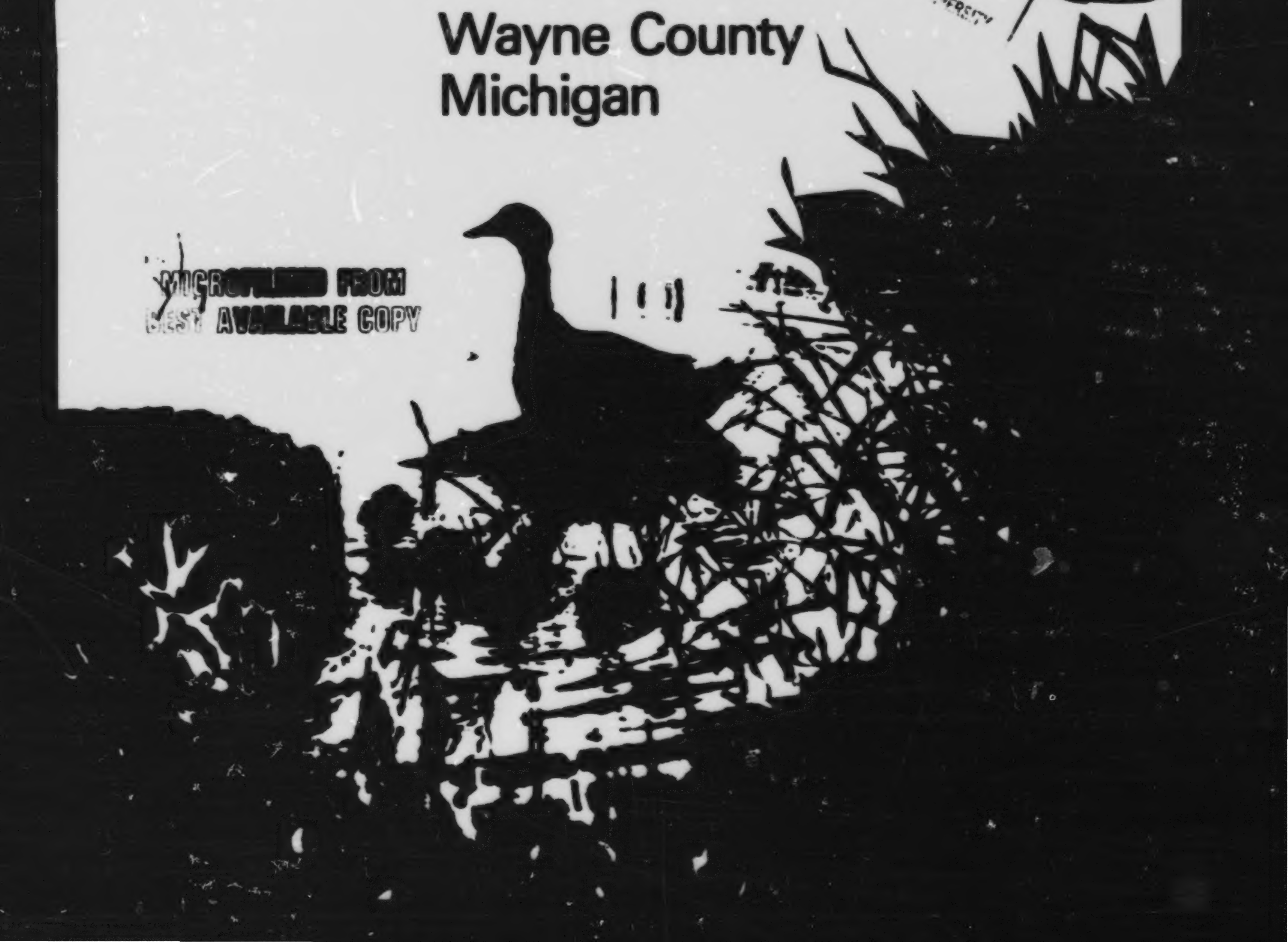


# DRAFT ENVIRONMENTAL IMPACT STATEMENT
# HURON VALLEY WASTEWATER CONTROL SYSTEM
# FACILITIES PLAN
## WAYNE AND OAKLAND COUNTIES, MICHIGAN

PROPOSED BY

WAYNE COUNTY DEPARTMENT OF PUBLIC WORKS

Prepared by the

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V, CHICAGO, ILLINOIS

AND

WAPORA, INCORPORATED

CHICAGO, ILLINOIS

APPROVED BY:

John McGuire
Regional Administrator
U.S. Environmental Protection Agency

November, 1978

## TABLE OF CONTENTS

Page

COVER SHEET . . . . . . . . . . . . . . . . . . . . . . . . . . i

TABLE OF CONTENTS . . . . . . . . . . . . . . . . . . . . . . . iii

LIST OF TABLES . . . . . . . . . . . . . . . . . . . . . . . . vii

LIST OF FIGURES . . . . . . . . . . . . . . . . . . . . . . . . viii

LIST OF ABBREVIATIONS . . . . . . . . . . . . . . . . . . . . . ix

GLOSSARY OF GEOGRAPHICAL TERMS . . . . . . . . . . . . . . . . x

SUMMARY . . . . . . . . . . . . . . . . . . . . . . . . . . . . xi

1.0. INTRODUCTION . . . . . . . . . . . . . . . . . . . . . . . 1
  1.1. Proposed Action . . . . . . . . . . . . . . . . . . . . 1
  1.2. Background. . . . . . . . . . . . . . . . . . . . . . . 1
  1.3. Study Process . . . . . . . . . . . . . . . . . . . . . 5

2.0. NATURAL ENVIRONMENT . . . . . . . . . . . . . . . . . . . 8
  2.1. Atmosphere . . . . . . . . . . . . . . . . . . . . . . 8
    2.1.1. Climate . . . . . . . . . . . . . . . . . . . . . . 8
    2.1.2. Air Quality . . . . . . . . . . . . . . . . . . . . 8
    2.1.3. Sound . . . . . . . . . . . . . . . . . . . . . . . 10
  2.2. Land . . . . . . . . . . . . . . . . . . . . . . . . . 10
    2.2.1. Physiography and Topography . . . . . . . . . . . . 10
    2.2.2. Geology. . . . . . . . . . . . . . . . . . . . . . 11
      2.2.2.1. Surficial Geology . . . . . . . . . . . . . . . 11
      2.2.2.2. Bedrock Geology . . . . . . . . . . . . . . . . 12
    2.2.3. Soil . . . . . . . . . . . . . . . . . . . . . . . 14
    2.2.4. Terrestrial Vegetation . . . . . . . . . . . . . . 17
      2.2.4.1. Woodlands . . . . . . . . . . . . . . . . . . . 17
      2.2.4.2. Brushlands and Grasslands. . . . . . . . . . . 18
      2.2.4.3. Agricultural Land . . . . . . . . . . . . . . . 18
      2.2.4.4. Wetlands . . . . . . . . . . . . . . . . . . . 18
      2.2.4.5. Endangered, Threatened, and Rare Plants. . . . 19
    2.2.5. Wildlife . . . . . . . . . . . . . . . . . . . . . 19
      2.2.5.1. Amphibians . . . . . . . . . . . . . . . . . . 19
      2.2.5.2. Reptiles . . . . . . . . . . . . . . . . . . . 21
      2.2.5.3. Birds . . . . . . . . . . . . . . . . . . . . . 21
      2.2.5.4. Mammals . . . . . . . . . . . . . . . . . . . . 21
      2.2.5.5. Endangered and Threatened Animals . . . . . . . 21
  2.3. Water . . . . . . . . . . . . . . . . . . . . . . . . . 22
    2.3.1. Surface Water . . . . . . . . . . . . . . . . . . . 22
      2.3.1.1. Setting and Flow . . . . . . . . . . . . . . . 22
      2.3.1.2. Uses . . . . . . . . . . . . . . . . . . . . . 28
      2.3.1.3. Water Quality . . . . . . . . . . . . . . . . . 29
    2.3.2. Groundwater . . . . . . . . . . . . . . . . . . . . 33
      2.3.2.1. Occurrence . . . . . . . . . . . . . . . . . . 33
      2.3.2.2. Groundwater Quality . . . . . . . . . . . . . . 34
      2.3.2.3. Uses . . . . . . . . . . . . . . . . . . . . . 34

TABLE OF CONTENTS (Cont.)

Page

2.3.3. Aquatic Biota . . . . . . . . . . . . . . . . . . . . 34
2.3.3.1. Upper and Lower Huron River. . . . . . . . 34
2.3.3.2. Middle and Lower Rivers Rouge. . . . . . . 35
2.3.3.3. Detroit River - Lake Erie. . . . . . . . . 35
2.3.3.4. Threatened and Endangered Species . . . . 36

3.0. MAN-MADE ENVIRONMENT. . . . . . . . . . . . . . . . . . . . . . 37
3.1. Demography and Economics . . . . . . . . . . . . . . . . 37
3.1.1. Demographic Trends . . . . . . . . . . . . . . . . 37
3.1.2. Population Projections . . . . . . . . . . . . . . 39
3.1.3. Income . . . . . . . . . . . . . . . . . . . . . . 40
3.1.4. Employment . . . . . . . . . . . . . . . . . . . . 42
3.1.5. Public Finance . . . . . . . . . . . . . . . . . . 47
3.2. Land Use and Transportation . . . . . . . . . . . . . . 54
3.2.1. General Land Use..... . . . . . . . . . . . . . . 54
3.2.2. Existing Land Use . . . . . . . . . . . . . . . . 54
3.2.3. Recreational Land . . . . . . . . . . . . . . . . 56
3.2.4. Housing . . . . . . . . . . . . . . . . . . . . . 56
3.2.5. Transportation . . . . . . . . . . . . . . . . . . 58
3.3. Cultural, Historic, and Archaeological Resources . . . . . 58
3.3.1. Prehistory of the Project Area . . . . . . . . . . 58
3.3.2. History of the Project Area . . . . . . . . . . . 60
3.3.3. Sites in the Project Area . . . . . . . . . . . . 61
3.4. Wastewater Collection and Treatment Systems . . . . . . . 64
3.4.1. Walled Lake - Novi . . . . . . . . . . . . . . . . 64
3.4.2. Rouge Valley System . . . . . . . . . . . . . . . 67
3.4.3. Downriver System . . . . . . . . . . . . . . . . . 69
3.4.4. Flat Rock . . . . . . . . . . . . . . . . . . . . 72
3.4.5. Rockwood . . . . . . . . . . . . . . . . . . . . . 73
3.4.6. W.C. - Trenton . . . . . . . . . . . . . . . . . . 74
3.4.7. Trenton . . . . . . . . . . . . . . . . . . . . . 75
3.4.8. Southern Brownstown Township . . . . . . . . . . . 77
3.4.9. Individual Disposal Systems . . . . . . . . . . . 78

4.0. FUTURE SITUATION WITHOUT ACTION . . . . . . . . . . . . . . . . 80

5.0. ALTERNATIVES ANALYSIS . . . . . . . . . . . . . . . . . . . . . 83
5.1. Introduction . . . . . . . . . . . . . . . . . . . . . . 83
5.2. Component Options . . . . . . . . . . . . . . . . . . . . 83
5.2.1. Flow and Waste Reduction . . . . . . . . . . . . . 83
5.2.1.1. Infiltration/Inflow Reduction. . . . . . . 83
5.2.1.2. Conservation of Water . . . . . . . . . . 84
5.2.1.3. Diversion of Flows . . . . . . . . . . . . 85
5.2.1.4. Flow Equalization . . . . . . . . . . . . 86
5.2.1.5. Industrial Pretreatment and/or Reuse . . . 86
5.2.2. Collection System . . . . . . . . . . . . . . . . 86
5.2.3. Wastewater Treatment Processes . . . . . . . . . . 88
5.2.3.1. Primary Treatment . . . . . . . . . . . . 89
5.2.3.2. Secondary Treatment . . . . . . . . . . . 89

TABLE OF CONTENTS (Cont.)

Page

5.2.3.2.1. Activated Sludge . . . . . . . . 89
5.2.3.2.2. Trickling Filter . . . . . . . . 89
5.2.3.2.3. Lagoons . . . . . . . . . . . . 90
5.2.3.2.4. Land Treatment . . . . . . . . . 90
5.2.3.3. Advanced Wastewater Treatment . . . . . . . 91
5.2.3.4. Disinfection . . . . . . . . . . . . . . . . 91
5.2.4. Effluent Disposal Methods and Sites . . . . . . . . . 91
5.2.5. Sludge Processing and Disposal . . . . . . . . . . . 92
5.2.5.1. Digestion . . . . . . . . . . . . . . . . . 92
5.2.5.2. Incineration . . . . . . . . . . . . . . . . 93
5.2.5.3. Pyrolysis . . . . . . . . . . . . . . . . . 93
5.2.5.4. Wet Oxidation . . . . . . . . . . . . . . . 93
5.2.5.5. Concentration of Sludge . . . . . . . . . . 94
5.2.5.6. Conditioning . . . . . . . . . . . . . . . . 94
5.2.5.7. Dewatering and Drying . . . . . . . . . . . 94
5.2.5.8. Land Disposal . . . . . . . . . . . . . . . 94
5.3. System Alternatives . . . . . . . . . . . . . . . . . . . . 95
5.3.1. Alternative A . . . . . . . . . . . . . . . . . . . . 95
5.3.1.1. Alternative A-1 . . . . . . . . . . . . . . 96
5.3.1.1.1. Components . . . . . . . . . . . 96
5.3.1.1.2. Construction and Operation Costs . . . . . . . . . . . . . 100
5.3.1.2. Alternative A-2 . . . . . . . . . . . . . . 101
5.3.1.2.1. Components . . . . . . . . . . . 101
5.3.1.2.2. Construction and Operation Costs . . . . . . . . . . . . . 103
5.3.2. Alternative B . . . . . . . . . . . . . . . . . . . . 104
5.3.2.1. Components . . . . . . . . . . . . . . . . . 104
5.3.2.2. Construction and Operation Costs . . . . . 107
5.3.3. Alternative C . . . . . . . . . . . . . . . . . . . . 107
5.3.3.1. Components . . . . . . . . . . . . . . . . . 107
5.3.3.2. Construction and Operation Costs . . . . . 110
5.3.4. Alternative D . . . . . . . . . . . . . . . . . . . . 110
5.3.4.1. Components . . . . . . . . . . . . . . . . . 110
5.3.4.2. Construction and Operation Costs . . . . . 114
5.3.5. Alternative E . . . . . . . . . . . . . . . . . . . . 117
5.3.5.1. Components . . . . . . . . . . . . . . . . . 117
5.3.5.2. Construction and Operation Costs . . . . . 122

6.0. IMPACTS OF ALTERNATIVES . . . . . . . . . . . . . . . . . . . . 125
6.1. Construction Impacts . . . . . . . . . . . . . . . . . . . 125
6.1.1. Impacts on the Natural and Man-Made Environment . . 125
6.1.2. Impacts on Local Public Finance . . . . . . . . . . 125
6.2. Operation Impacts . . . . . . . . . . . . . . . . . . . . 138
6.2.1. Impacts on the Natural and Man-Made Environment . . 138
6.2.2. Impacts on Local Public Finance . . . . . . . . . . 138
6.2.2.1. Alternative A-1 . . . . . . . . . . . . . . 145
6.2.2.2. Alternative A-2 . . . . . . . . . . . . . . 147
6.2.2.3. Alternative B . . . . . . . . . . . . . . . 148
6.2.2.4. Alternative C . . . . . . . . . . . . . . . 149
6.2.2.5. Alternative D . . . . . . . . . . . . . . . 150
6.2.2.6. Alternative E . . . . . . . . . . . . . . . 150

TABLE OF CONTENTS (Concluded)

Page

6.3. Secondary Impacts . . . . . . . . . . . . . . . . . . . . . . . . . 150
    6.3.1. Indirect and Induced Growth . . . . . . . . . . . . . 151
    6.3.2. Impacts of Induced Growth . . . . . . . . . . . . . . 152
6.4. Minimization of Adverse Impacts . . . . . . . . . . . . . . . 152
    6.4.1. Construction Impacts . . . . . . . . . . . . . . . . . 152
    6.4.2. Operation Impacts . . . . . . . . . . . . . . . . . . . . 156
    6.4.3. Secondary Impacts . . . . . . . . . . . . . . . . . . . . 159
6.5. Unavoidable Adverse Impacts . . . . . . . . . . . . . . . . . . 159
6.6. Irretrievable and Irreversible Resource Commitments . . . . 160
6.7. Short-term Versus Long-term Impacts . . . . . . . . . . . . . 161

7.0. CONCLUSIONS AND RECOMMENDATIONS . . . . . . . . . . . . . . . . 162
7.1 Conclusions........................................... 162
7.2 Recommendations ...................................... 163
8.0 LITERATURE CITED ..................................... 166

# LIST OF TABLES

Page

1. Threatened plants . . . . . . . . . . . . . . . . . . . . . . . . . 20
2. Phosphorus loads to Lake Erie . . . . . . . . . . . . . . . . . . . . 33
3. Population trends . . . . . . . . . . . . . . . . . . . . . . . . . 38
4. Population projections . . . . . . . . . . . . . . . . . 41
5. Income, owner occupied units, populations, wholesale trade, and retail trade . . . . . . . . . . . . . . . . . . . . . . . . . . . 43
6. Basic, local, and total employment . . . . . . . . . . . . . . . . 44
7. Debt, taxes, and SEV for ten cities . . . . . . . . . . . . . . . . 48
8. Debt, taxes, and SEV for townships . . . . . . . . . . . . . . . . 51
9. Occupied dwelling units . . . . . . . . . . . . . . . . . . . . . . 57
10. Median values of homes . . . . . . . . . . . . . . . . . . . . . . 57
11. Chemical characteristics of sludge . . . . . . . . . . . . . . . . 66
12. RVSDD service area and population . . . . . . . . . . . . . . . . 68
13. Utilization of RVSDD capacity . . . . . . . . . . . . . . . . . . 70
14. Average contributions of domestic and industrial flows . . . . . 71
15. Ultimate population served by Alternative A-1 & A-2. . . . . . . . . . 97
16. Capital, salvage value, and O&M costs for Alternative A-1 . . . . 102
17. Capital, salvage value, and O&M costs for Alternative A-2 . . . . 105
18. Capital, salvage value, and O&M costs for Alternative B . . . . . 108
19. Capital, salvage value, and O&M costs for Alternative C . . . . . 111
20. Capital, salvage value, and O&M costs for Alternative D . . . . . 115
21. Ultimate population served by Alternative E . . . . . . . . . . . 119
22. Potential future flows to the RVSDD and DD. . . . . . . . . . . . 120
23. Existing and projected capacities of six project area WWTPs . . . 121
24. Capital, salvage value, and O&M costs for Alternative E . . . . . 124
25. Construction impacts . . . . . . . . . . . . . . . . . . . . . . . 126
26. Allocation of capital costs for Alternative A-1 . . . . . . . . . 132
27. Allocation of capital costs for Alternative A-2 . . . . . . . . . 133
28. Allocation of capital costs for Alternative B . . . . . . . . . . 134
29. Allocation of capital costs for Alternative C . . . . . . . . . . 135
30. Allocation of capital costs for Alternative D . . . . . . . . . . 136
31. Allocation of capital costs for Alternative E . . . . . . . . . . 137
32. Operation impacts . . . . . . . . . . . . . . . . . . . . . . . . 139
33. Cost comparison for six alternatives . . . . . . . . . . . . . . 146
34. Secondary impacts . . . . . . . . . . . . . . . . . . . . . . . . 153

## LIST OF FIGURES

Page

1. Location of the project region/project area . . . . . . . . . . . . . 2
2. Surface geology . . . . . . . . . . . . . . . . . . . . . . . . . 13
3. Soil. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 15
4. Huron River basin . . . . . . . . . . . . . . . . . . . . . . . . 23
5. River Rouge basin . . . . . . . . . . . . . . . . . . . . . . . . 26
6. Archaeological and historic sites . . . . . . . . . . . . . . . . . 59
7. Sewage collection districts . . . . . . . . . . . . . . . . . . . . 65
8. Alternatives A-1 and A-2. . . . . . . . . . . . . . . . . . . . . . 99
9. Alternative B . . . . . . . . . . . . . . . . . . . . . . . . . . 106
10. Alternative C . . . . . . . . . . . . . . . . . . . . . . . . . . 109
11. Alternative D . . . . . . . . . . . . . . . . . . . . . . . . . . 113
12. Alternative E . . . . . . . . . . . . . . . . . . . . . . . . . . 118

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AQCR | Air Quality Control Region |
| $BOD_5$ | 5-Day Biochemical Oxygen Demand |
| cfs | cubic feet per second |
| COD | Chemical Oxygen Demand |
| CSO | Combined Sewer Overflow |
| DD | Downriver District |
| DPW | Department of Public Works |
| EIS | Environmental Impact Statement |
| GLBC | Great Lakes Basin Commission |
| HRWC | Huron River Watershed Council |
| HVWWCS | Huron Valley Wastewater Control System |
| I/I | Infiltration/Inflow |
| MDNR | Michigan Department of Natural Resources |
| mgd | million gallons per day |
| MWRC | Michigan Water Resources Commission |
| $NH_3$-N | Nitrogen as Ammonia |
| NPDES | National Pollutant Discharge Elimination System |
| O&M | Operation and Maintenance |
| Total P | Total Phosphorus |
| RVSDD | Rouge Valley Sewage Disposal District |
| SEMCOG | Southeast Michigan Council of Governments |
| SHPO | State Historic Preservation Officer |
| SS | Suspended Solids |
| SSES | Sewer System Evaluation Survey |
| TKN | Total Kjeldahl Nitrogen |
| US-EPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WWTP | Wastewater Treatment Plant |

## GLOSSARY OF GEOGRAPHICAL TERMS

*PROJECT AREA* - The Huron Valley project area includes White Lake, Commerce, and Novi Townships, and the City of Novi in the southwestern part of Oakland County; the western and southern tier of communities in Wayne County, including the Townships of Northville, Plymouth, Canton, Van Buren, Sumpter, Huron, and Brownstown, and the Cities of Northville, Plymouth, Belleville, Flat Rock, Rockwood, Woodhaven, Trenton, and Gibraltar; and the City of South Rockwood in Monroe County (See Figure 1, page 2).

*PROJECT REGION* - The Huron Valley project region includes Wayne County and sections of Oakland, Washtenaw, and Monroe Counties, Michigan (See Figure 1, page 2).

*PROJECT CORRIDOR* - The project corridor is a 1.0-mile-wide strip of land centered on the conceptual alignment of the proposed Huron Valley Interceptor. The corridor also includes the area in the vicinity of the proposed wastewater treatment plant in Brownstown Township, Wayne County, Michigan.

*SEMCOG REGION* - The planning region of the Southeast Michigan Council of Governments (SEMCOG) includes seven counties: Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne.

*US-EPA REGION V* - Region V of the United States Environmental Protection Agency (US-EPA) includes six states: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. The regional headquarters are located at Chicago.

*EAST NORTH CENTRAL REGION* - This statistical area, used by the US Bureau of Labor Statistics, includes all of the states in US-EPA Region V except Minnesota.

*DETROIT SMSA* - The Detroit Standard Metropolitan Statistical Area includes Lapeer, Livingston, Macomb, Oakland, St. Clair, and Wayne Counties, Michigan.

*GREAT LAKES REGION* - The Great Lakes Region includes the State of Michigan and sections of Minnesota, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania, and New York.

# SUMMARY

(X) Draft Environmental Impact Statement
( ) Final Environmental Impact Statement
US Environmental Protection Agency
Region V
Chicago, Illinois

## 1. NAME OF ACTION

Administrative (X)
Legislative ( )

## 2. DESCRIPTION OF THE PROPOSED ACTION

The Wayne County, Michigan, Department of Public Works proposes to construct the Huron Valley Wastewater Control System (HVWWCS) to provide wastewater disposal service to the western and southern areas of Wayne County and to part of southern Oakland County. The applicant's proposed project consists of a regional interceptor sewer approximately 50 miles long and a 49.2 mgd wastewater treatment plant (WWTP) which would be built adjacent to Lake Erie. The new treatment facility would provide conventional secondary treatment with phosphorus removal. Effluent would be discharged via a 10,000-foot outfall sewer to the mid-channel confluence of the Detroit River and Lake Erie. Existing treatment plants in the project area would be abandoned. The applicant's proposed action is referred to in this document as Alternative A-1.

Federal financing has been requested by the applicant under the statutory authority of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and the Clean Water Act Amendments of 1977 (PL 95-217). The facilities planning consultant has estimated that the total capital cost for the system would be $147,393,000 (adjusted to January 1978 price levels). The total capital cost was recalculated by WAPORA, Inc. and has been estimated to be $207,001,000. Average annual operation and maintenance costs have been estimated at $4,643,000.

## 3. ENVIRONMENTAL IMPACTS

The major primary environmental impacts which are likely to be associated with Alternative A-1 would result from construction and operation of the interceptor and wastewater treatment plant. These impacts are discussed in Section 6.1. of the draft Environmental Impact Statement (EIS) and are summarized in the following paragraphs. Many of the potentially adverse effects may be reduced or eliminated by various mitigation measures, which are discussed in Section 6.4.

### AIR QUALITY, NOISE, AND ODORS

Construction activities would result in the generation of fugitive dust and in the emission of fumes and hydrocarbon combustion products from construction equipment. Noise from drilling, excavating, and equipment would be discernible up to 2,000 feet from construction sites.

Operations at the new WWTP would release malodorous gases and vapors. Sludge incineration would produce controlled emissions of up to 50 pounds per day of particulates. A minimal increase in ambient noise levels would occur at the proposed WWTP and Trenton Pump Station sites. Odors and operational noise from the six existing WWTPs would be eliminated.

## GEOLOGY, SOILS, AND TOPOGRAPHY

Disposal of spoil materials from both open-trench excavation and tunneling could alter topography to a limited extent along the interceptor right-of-way. Settling in trenched areas would alter the existing topography and soil regime to a limited extent. No major operational impacts are anticipated.

## TERRESTRIAL BIOTA

Open-cut excavation for emplacement of the main-stem interceptor would disturb plants and animals on as many as 400 acres along the right-of-way. Additional disturbance would result from construction of the Trenton and Van Buren-Sumpter Arms and at the WWTP site. The most significant impacts are likely to occur in the lake regions in Commerce Township and along the Middle Rouge and Huron Rivers. No state or federally designated endangered species are known to exist in the project corridor, although the conceptual route contains the general habitat requirements for five plant species which are considered by the State of Michigan to be imperiled.

## WETLANDS

The proposed interceptor would cross or be located adjacent to 10.9 miles of open or wooded wetlands. During construction, natural cover would be removed, drainage patterns may be altered, and wetland habitat for state-designated imperiled plants may be disturbed. Dewatering of trenches and tunnels temporarily would lower adjacent groundwater levels, potentially killing vegetation by dessication. Elimination of the effluent discharge from the Walled Lake WWTP may result in a decline in wetland productivity in the Walled Lake Branch area, especially during periods of low flow. A total plant failure at the proposed regional WWTP could have a minimal adverse impact on the wetlands on the western shore of Lake Erie.

## SURFACE WATER

Rivers and drainageways crossed by the regional interceptor would be affected adversely by construction. Increased turbidity and sedimentation would occur. Limited or interrupted flows could result for short periods of time. Temporary water quality degradation may result as impoundments receive silt-laden flows from affected watercourses.

Long-term beneficial effects should result from abandonment of the six existing wastewater treatment facilities. Inland waterways no longer would receive effluent, and total phosphorus loadings to Lake Erie should be reduced. The elimination of discharges from the Walled Lake WWTP may result in seasonal lowering of downstream lake levels. Flow rates of the Huron River would be affected only minimally. Impacts on Lake Erie would be limited. A total plant failure could result in short-term violations of water quality standards.

## GROUNDWATER

Temporary lowering of groundwater levels in the vicinity of the regional interceptor sewer may occur. Local, shallow wells may be affected, especially in the northern section of the project area. Widespread availability of public sewer service would reduce the use of septic systems and lessen the potential for groundwater pollution.

## DEMOGRAPHY AND ECONOMICS

An estimated 1,250 construction-related jobs would be created during three construction seasons. Expenditures for system construction would result in short-term induced and indirect employment in other sectors of the southeast Michigan economy and in areas which supply materials for the project. Few residents would be displaced by construction activities. Employment at existing WWTPs in the project area would be eliminated but additional jobs would be created at the new regional WWTP.

## LAND USE

Construction of the regional WWTP permanently would alter existing land use at the site of the Brownstown Township wastewater stabilization lagoons. Adjacent land use also would be affected. Construction of the interceptor sewer through parks and recreation areas temporarily would disrupt public use and enjoyment of affected areas. The site of the regional WWTP is located within the estimated 100-year maximum lake-level plain of Lake Erie.

## TRANSPORTATION

Access to homes and businesses may be interrupted temporarily by construction activities. Vehicular traffic flow would be affected by interceptor emplacement across or adjacent to streets and roads. Traffic congestion would result from the movements of heavy equipment and vehicles associated with construction. Roadway surfaces may be damaged locally.

## CULTURAL, HISTORIC, AND ARCHAEOLOGICAL RESOURCES

No cultural, historic, or archaeological sites are known to exist at the proposed location of the regional WWTP in Brownstown Township. There is a strong possibility that excavation for the emplacement of the regional interceptor may destroy significant archaeological sites, especially in the Lower Huron, Willow, and Oakwoods Metroparks. It also is possible that construction may result in the discovery of sites which otherwise might not be found.

## RESOURCE USE

Implementation of Alternative A-1 would commit $207 million irretrievably. Engineering, administrative, legal, construction, and other labor would be committed. Material resources and energy would be devoted to construction of the interceptor and to construction and operation of the new regional WWTP. The land required for the interceptor alignment and WWTP site would be dedicated to wastewater management use for the useful life of the facilities (estimated to be 50 years).

PUBLIC FINANCE

Federal (75%), State (5%), and local (20%) funding in the amount of $207 million would be required for implementation of the proposed action. The impact of such expenditures would vary from community to community. Some municipalities, most notably the City of Woodhaven, may have difficulty in assuming new public indebtedness of the magnitude required for participation in the HVWWCS. If user charges were not sufficient to pay for construction and for operation and maintenance costs, a special assessment and/or increased taxes would be required. The expenditure of large sums for wastewater treatment system construction and operation represents a significant social cost because of the monies which no longer would be available for other public uses.

AESTHETICS

Construction activities would result in temporary adverse effects on the aesthetic quality of the environment in and along the interceptor route and at the site of the regional WWTP. Removal of vegetation along the right-of-way and at the Brownstown Township site, and construction activity in wooded areas, wetlands, parklands, and adjacent to and across waterways could reduce visual appreciation of the landscape.

PUBLIC HEALTH

The widespread dependence on septic systems in areas presently without sewers would be reduced. Potential health problems resulting from contamination of soil, groundwater, and surface water by septic system effluent would be limited. Areas which would continue to rely upon on-site disposal systems (such as White Lake Township) would have the potential for future localized development of health problems.

The waters of the designated mixing zone for effluent from the regional WWTP potentially would be hazardous for body-contact recreation. A total plant failure could result in a temporary health hazard outside the mixing zone.

The major secondary impacts which are likely to be associated with Alternative A-1 would result from increased development and land use changes encouraged by the widespread availability of public wastewater treatment service in the project area. The major long-term effects which are likely to result from increased urbanization in the project area include:

- Modification of productive soils and local topography
- Loss of biological and economic productivity from destruction of natural vegetation, wetlands, wildlife habitat, and agricultural lands
- Increased runoff would degrade surface waters
- Increased local employment and income

- Significant expansion of public services with a consequent need for increased public revenues
- Expansion of local tax base
- Changes in long-term energy requirements resulting from commuting patterns, housing location, and density of new development
- Loss of population from existing urban areas (especially Detroit) through migration to the project area.

## 4. ALTERNATIVES CONSIDERED

In addition to Alternative A-1, five other alternatives were considered in detail (see Section 5.3.). Brief descriptions of these alternatives are presented here. Impacts associated with each alternative are itemized in Tables 25, 32, and 34. Many other alternatives were discussed at public meetings held during preparation of the Facility Plan and the EIS. These were not included in the analysis of final alternatives because of system cost, adverse impacts, etc. (see Section 5.0.).

### ALTERNATIVE A-2

Alternative A-2 would serve the same communities as would Alternative A-1. The maximum population projected to be provided with interceptor capacity by this alternative is 332,650 (versus 374,808 projected in Alternative A-1). The proposed route of the regional interceptor sewer in Alternative A-2 is identical to that of Alternative A-1. Existing WWTPs would be abandoned and a regional plant would be constructed in Brownstown Township. A detailed discussion of Alternative A-2 is provided in Section 5.3.1.2.

### ALTERNATIVE B

Alternative B conceptually represents Wayne County's original Alternative III. A projected 364,500 persons in the project area would be served by the regional system. Alternative B would provide service to areas not included in Alternatives A-1 and A-2 (i.e., White Lake Township, Belleville, and Wolverine Lake). The route of the regional interceptor would be similar to that proposed in Alternatives A-1 and A-2 but would extend into White Lake Township. Existing WWTPs would be abandoned and a regional plant would be built in Brownstown Township. A detailed discussion of Alternative B is provided in Section 5.3.2.

### ALTERNATIVE C

Alternative C would serve the same sewered population as Alternative B, except that the communities from northern Novi to White Lake Township would be served by an expanded and upgraded Walled Lake WWTP instead of by the regional system. A new interceptor would be built to convey flows from the White Lake Township boundary to the Walled Lake facility. The regional interceptor would originate in central Novi and would convey flows to the regional WWTP in Brownstown Township. The remaining five existing WWTPs would be abandoned. Details of Alternative C are presented in Section 5.3.3.

### ALTERNATIVE D

Alternative D incorporates the same wastewater management system for the northern communities as does Alternative C. Contractual capacities held by project area communities in existing interceptor systems would be redistributed in the central section of the project area. As a result, the regional interceptor would be required only as far north as Canton Township. The interceptor route, regional plant site, treatment processes, and methods of effluent and sludge disposal are the same as described for previous alternatives. The five existing WWTPs in the southeastern section of the project area would be abandoned. Alternative D is described in Section 5.3.4.

### ALTERNATIVE E

Alternative E includes upgrading and expansion of the five existing WWTPs in the southeast part of the project area and the continued operation of the Walled Lake WWTP. Only limited numbers of the projected 1995 population would be provided with centralized wastewater treatment. Alternative E offers no wastewater disposal solution for Sumpter, Commerce, or White Lake Townships These communities would have to rely on septic disposal systems or on some other local solution. A detailed discussion of this alternative is presented in Section 5.3.5.

## 5. RECOMMENDATIONS

The US-EPA recommends the design and construction of Alternative D. This system appears to be the most cost-effective alternative providing adequate wastewater treatment facilities to resident populations and should meet project area needs. Other alternatives have major secondary impacts which would be difficult to mitigate. Alternative D would have a reduced potential for the encouragement of out-migration from the City of Detroit and would aid in the continued utilization of existing infrastructural investments. This is consistent with national urban policy.

## 6. FEDERAL, STATE, AND LOCAL AGENCIES, GROUPS, AND INDIVIDUALS NOTIFIED OF THIS ACTION

### FEDERAL

Hon. Robert Griffin, US Senate
Hon. John Riegle, Jr., US Senate
Hon. John Conyers, US House of Representatives
Hon. John Dingell, US House of Representatives
Hon. Jack McDonald, US House of Representatives
Hon. Lucien Nedzi, US House of Representatives
Hon. James O'Hara, US House of Representatives
Hon. Charles Diggs, US House of Representatives
Hon. William Ford, US House of Representatives
Hon. William Broonfield, US House of Representatives
Council on Environmental Quality

- US Environmental Protection Agency
  - Region I
  - Region II
  - Region III
  - Region IV
  - Region V
  - Region VI
  - Region VII
  - Region VIII
  - Region IX
  - Region X
  - Facilities Requirement Branch
  - Environmental Evaluation Branch
  - Office of Public Affairs
  - Public Information Reference Unit
  - Office of Federal Activities
  - Office of Legislature
  - Michigan - Ohio District Office
- Department of Defense
  - US Army Engineer, Missouri River Division
  - US Army Engineer, Ohio River Division
  - US Army Engineer, Lower Mississippi River Valley Division
  - US Army Engineer, North Central Division
    - Detroit District
    - St. Paul District
    - Chicago District
- Department of Transportation
  - Region V
  - US Coast Guard
  - Federal Highway Administration
  - Federal Aviation Administration
  - Federal Railroad Administration
- Department of Interior
  - Bureau of Indian Affairs
  - US Fish and Wildlife Service
  - National Park Service
  - Bureau of Mines
  - Bureau of Land Management
  - Historic Resource Preservation Commission
- Department of Health, Education and Welfare
  - Office of Environmental Affairs
  - Region V
- Department of Labor
- Department of Housing and Urban Development
- Department of Commerce
- Department of Agriculture
- Advisory Council on Historic Preservation
- Water Resources Council

## STATE

Office of the Governor
The Clerk, State Senate
Conservation Committee, State Senate
The Clerk, House of Representatives
Conservation Committee, House of Representatives
Bureau of Management and Budget
Department of State Highways
Department of Natural Resources
Attorney General
Department of Public Health
Department of Agriculture
Historic Preservation Officer
Water Resources Commission
Pointe Mouillee State Game Area

## REGIONAL AND LOCAL

### Multi-Jurisdictional Agencies

- Huron-Clinton Metro Authority
- Southeastern Michigan Transportation Authority
- Great Lakes Basin Commission
- Inter-County Highway Department of Southeast Michigan
- Southeast Michigan Council of Governments
- Ohio River Basin Commission
- Upper Mississippi River Basin Commission
- Huron River Watershed Council

### Counties and County Agencies

- Wayne County
  - Department of Health
  - Department of Public Works
  - Board of Commissioners
  - Board of Auditors
  - Drain Commissioner
  - Agricultural Stabilization and Conservation Service
  - Cooperative Extension Service

- Oakland County
  - Department of Health
  - Department of Public Works
  - Board of Commissioners
  - Planning Commission
  - Drain Commissioner

- Monroe County
  - Department of Health
  - Board of Commissioners
  - Planning Commission
  - Drain Commissioner

Washtenaw County
  - Board of Public Works
  - Drain Commissioner

Townships

- Brownstown
- Canton
- Commerce
- Huron
- Monroe
- Northfield
- Northville
- Plymouth
- Sumpter
- Van Buren
- White Lake

Municipalities

- City of Detroit
  - Office of the Mayor
  - Planning Department
  - Board of Water Commissioners
  - Water and Sewerage Department
- Walled Lake
- Wolverine Lake
- Novi
- Northville
- Plymouth
- Belleville
- Flat Rock
- Rockwood
- Trenton
- Gibraltar
- Woodhaven
- South Rockwood
- Farmington
- Livonia
- Wayne
- Romulus
- Westland
- Wixom
- Monroe
- Taylor
- Wyandotte
- Ypsilanti
- Southgate
- Riverview
- Lake Orion
- Milford

Organizations and Individuals

Center for Urban Affairs
Sierra Club
Morgan Library, Colorado State University
League of Women Voters
Environmental Defense Fund, Inc.
Izaak Walton League of America
School of Natural Resources, University of Michigan
National Wildlife Federation
Natural Resources Defense Council, Inc.
Dr. Gordon McCallum
Boyd L. Rasmussen
Walter R. Courtenay
Harold Hochmuth
International Association of Game Fish and Conservation
Michigan United Conservation Clubs
Detroit Audubon Society
Citizens for Survival
Detroit Area Coalition for the Environment
Rouge Basin Coalition
Rescue the Rouge Committee
Citizens for Environmental Action
Friends of Earth
Citizens Action for Clean Water
Limnos
Michigan Environmental Information Center
Soil Conservation Society of America
Citizens for Clean Air
Michigan Lake and Stream Association, Inc.
Michigan Association of Conservation Ecologists
Hubbell, Roth & Clark,Inc.
Lake Oakland Association
Keep Michigan Beautiful Inc.
Wolverine Lake Association
Citizens Opposed to Super Sewer
Michigan AAUW
Great Lakes Foundation, University of Michigan
The Huron River Group
Institute for Environmental Quality, University of Michigan
Lake Erie Cleanup Committee, Inc.
Dearborn Naturalist Association, University of Michigan
Helping Our Polluted Environment
Wade, Trim & Associates, Inc.
Lake Erie Advisory Committee
Monroe Environmental Action Committee
Pointe Mouillee Waterfowlers Association
Monroe County Rod & Gun Club
People for Lasting Ecology
Brender, Hammel and Associates
Environmental Awareness Committee, Geneva Presbyterian Church
Pointe Mouillee Home & Environmental Protection Association
City Beautiful Commission
Citizens to Protect Waterways

Committee to Protect our Water and Wetlands
Pointe Mouillee Homeowners Association
Concerned Citizens for Berlin Township
Michigan Audubon Society
Down River Community Conference
SAVE, Eastern Michigan University
Society to Overcome Pollution
Michigan Botanical Club
Conservation for Survival
Institute of Water Research, Michigan State University
Michigan Recreation and Parks Association
Environmental Action

## 1.0. INTRODUCTION

The Wayne County, Michigan, Department of Public Works (DPW; formerly the Wayne County Road Commission) proposed to construct the Huron Valley Wastewater Control System to provide wastewater disposal service to the western and southern areas of Wayne County and to part of southern Oakland County (Figure 1). The DPW (on behalf of local units of government potentially served by this project) prepared a "Step I" Facilities Plan and applied to the State of Michigan and to the United States Environmental Protection Agency (US-EPA) for funding of the proposed treatment works under the State and Federal Municipal Wastewater Treatment Works Construction Grants Programs. The Michigan Department of Natural Resources (MDNR) certified the DPW's Facility Plan and their "Step II" application for funds for detailed engineering design, and forwarded it to US-EPA, Region V, for consideration.

The National Environmental Policy Act of 1969 (NEPA) requires a Federal agency to prepare an environmental impact statement (EIS) on "...major Federal actions significantly affecting the quality of the human environment..." The US-EPA published Regulations (40 CFR Part 6) to guide its determination of whether Federal funds which it commits through the Construction Grants Program would result in a project significantly affecting the environment. Pursuant to these regulations and subsequent guidelines, US-EPA, Region V, determined that an EIS must be prepared for the Huron Valley Wastewater Control System before a grant could be approved.

### 1.1. Proposed Action

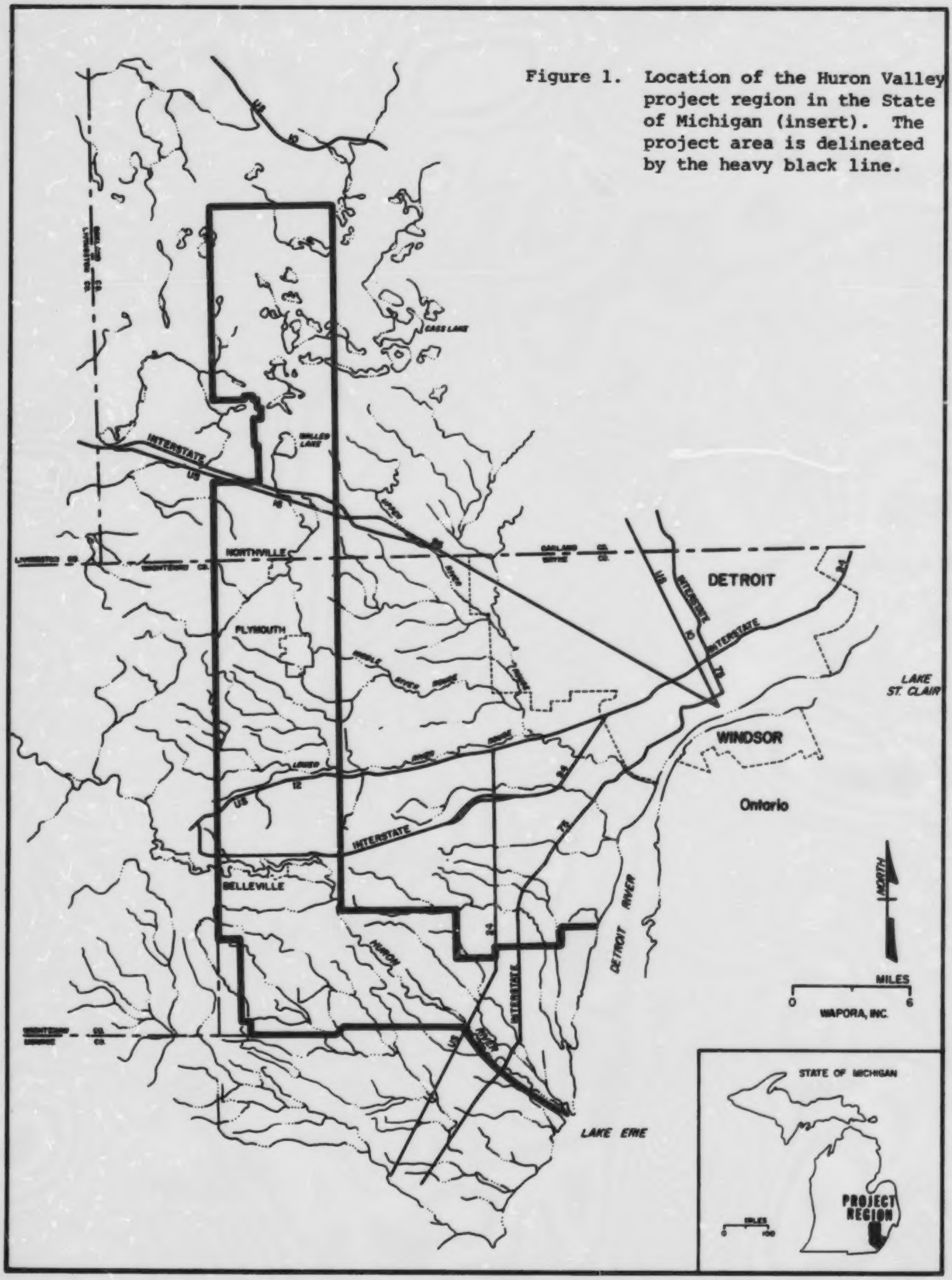
The Wayne County DPW's current proposal for the Huron Valley Wastewater Control System is "Alternate III-Modified Wayne/Oakland Segment". The project consists of a regional interceptor and wastewater treatment plant (WWTP). The main-stem interceptor would extend from the proposed WWTP site in southeastern Brownstown Township northwesterly along the Lower Huron River to Hannan Road. From there the interceptor would be routed north along Hannan Road and the Middle River Rouge, and then north through Novi and into Commerce Township in Oakland County (Figure 8). The interceptor would have two arms, one from the WWTP site north to Trenton and one extending west into Sumpter and Van Buren Townships.

The Wayne County DPW's facility planning consultant estimated the total capital cost for this system to be $147,393,000 at January 1978 price levels (Hubbell, Roth & Clark, Inc. 1976; estimate revised 16 September 1977). The total capital cost was recalculated by WAPORA, Inc. and has been estimated to be $207,001,000. This system and other alternatives for the project area are evaluated in Section 5.

### 1.2. Background

The concept of a regional control system to serve the western and southern sections of Wayne County was first proposed by the Wayne County Road Commission in 1959. The first phase of the plan, the Rouge Valley and Downriver wastewater control systems, was operational by 1964. The second phase was proposed to be implemented by about 1980 when the communities in the far western and southern tiers of townships in the county were expected to have developed sufficiently to make a regional interceptor system economical.

Figure 1. Location of the Huron Valley project region in the State of Michigan (insert). The project area is delineated by the heavy black line.


CASS LAKE
INTERSTATE
US
NORTHVILLE
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
DETROIT
PLYMOUTH
INTERSTATE
LAKE ST. CLAIR
WINDSOR
Ontario
INTERSTATE
US 12
BELLEVILLE
HURON
DETROIT RIVER
INTERSTATE
NORTH
MILES
0
6
WAPORA, INC.
WASHTENAW CO.
MONROE CO.
LAKE ERIE
STATE OF MICHIGAN
PROJECT REGION
MILES
0
100

The second phase plan anticipated that a new, regional wastewater treatment plant (WWTP) would be built near the mouth of the Huron River. Wastewater generated in the western and southern townships of the county was to be conveyed via a regional interceptor to the WWTP. Treated effluent was to be discharged to Lake Erie.

In 1962, the Huron River Watershed Council (HRWC) recommended that the second phase system be enlarged by extending an arm of the interceptor along the Huron River to allow for the abandonment of the WWTPs which discharged to the Huron River at Ann Arbor and at Ypsilanti. Preliminary planning proceeded which incorporated this additional area. In 1970, however, Ann Arbor and Ypsilanti requested the MDNR to approve independent expansions of their existing WWTPs. Instead, the MDNR adopted a plan (based on an independently commissioned study) which was similar to the HRWC plan. The MDNR plan expanded the HRWC plan to include a section of Oakland County.

Implementation of the proposed system was delayed by opponents of the plan and by the need to wait for the availability of Federal grant funds. Under provisions of the 1972 Federal Water Pollution Control Act Amendments, a "Facility Plan" is required for a project before it can qualify for a Federal grant. Wayne and Washtenaw Counties completed a joint Facility Plan for the planning area in May 1976. The Facility Plan recommended that the previously proposed, enlarged planning area, with the addition of Trenton, Woodhaven, Gibralter, and central Brownstown Township in southeast Wayne County, be serviced by a regional wastewater treatment system.

Communities in Washtenaw County opposed participation in a regional system which would be governed by Wayne County. The Michigan Water Resources Commission acted on 21 May 1976 to divide the planning area into three distinct project areas. This allowed the Washtenaw County communities of Ann Arbor and Ypsilanti to expand and to upgrade their existing facilities with autonomous administration. This left the Wayne and southern Oakland County section, and the other Oakland County area as independent project areas without approved plans.

Wayne County, therefore, had to consider one of the other appropriate alternatives presented in the Facility Plan: 1) Alternate III, which would provide a regional WWTP at the mouth of the Huron River with a regional interceptor sewer extending the length of the project area with branches serving the southeastern and Sumpter-Van Buren Township areas; 2) Alternate XIII, which is similar to III except northern Novi, and Commerce and White Lake Townships in Oakland County would be served by the expansion of the Walled Lake WWTP; and 3) Alternate VB, which would expand and upgrade the six existing WWTPs in the project area, and build one new plant at French Landing in Wayne County to serve the western townships.

After numerous meetings, fourteen communities in Wayne County and three in Oakland County agreed to proceed with Alternate III. The Monroe County Community of South Rockwood, which presently utilizes the Rockwood WWTP in the project area, also expressed interest in joining the system. Communities choosing not to participate included White Lake Township and Wolverine Lake Village in Oakland County, and Plymouth and Belleville in Wayne County.

The Wayne County DPW modified the proposed system and designated it "Alternate III-Modified Wayne/Oakland Segment". In March 1977, the DPW applied to the MDNR for State and Federal "Step II" funds for detailed engineering and design of the system. At the same time, the DPW submitted the proposed cost-sharing schedule for "Step II" local costs to the participating communities for their execution of agreements for payment.

The MDNR approved this plan on 24 September 1976 and forwarded it to US-EPA, Region V, for consideration. On 5 July 1977, US-EPA issued a Notice of Intent to Prepare an Environmental Impact Statement on the proposed Huron Valley Wastewater Control System.

> *The Huron River Valley system poses unique and complex problems which have significant impacts. No clear cut cost-effective solution was identified within the facilities plan. Our review of the alternatives indicates that the following issues must be further considered in an environmental impact statement.*
>
> *1) Documentation of existing pollution problems throughout the plan of study area.*
>
> *2) Coordination of the service area with the Detroit system to obtain the optimum utilization of existing and mandated facilities. This includes east-west relief interceptors to both Detroit and Wyandotte.*
>
> *3) Evaluation of the impact of sewer routings and river crossings on wetlands and water quality.*
>
> *4) Evaluation of regional demographics to ensure compatibility with current State and SEMCOG population projections.*
>
> *5) Evaluate cost data for options which do not include Washtenaw County or the lower Huron Valley communities of Flat Rock, Trenton, Brownstown, Gibraltar, and Rockwood.*
>
> *6) Secondary growth impacts encouraged by the project include: change in population density, rate of growth, non-point sources of pollution due to urbanization and land use forecasts. These impacts are all inadequately addressed by the facilities plan.*

As a result, the US-EPA, Region V, obtained the assistance of a consultant, WAPORA, Inc., to assist in the collection of background information, to consider alternatives to the proposed action, and to analyze the effects of the various alternatives.

## 1.3. Study Process

The bulk of the work on the preparation of this draft EIS occurred between October 1977 and August 1978. During this period, WAPORA, Inc., submitted various interim contract reports to US-EPA, including "Existing Environmental Conditions in the Huron Valley Project Area" and "System Alternatives and Alternatives Evaluation for the Huron Valley Wastewater Control System".

Public meetings were sponsored by US-EPA to facilitate public involvement during the preparation of the EIS:

| Date | Location | Subject |
|---|---|---|
| 7 December 1977 | Westland | Study Process and Discussion of EIS Issues |
| 24 January 1978 | White Lake Township | Existing Environmental Conditions |
| 30 March 1978 | Trenton | Existing Conditions and Alternatives Development Process |
| 11 May 1978 | Plymouth | System Alternatives and Their Impacts |

Several informational newsletters also were prepared during that time and were mailed to persons who previously had expressed interest in the project.

During July 1978, systems alternatives and their costs were discussed by US-EPA, Region V; WAPORA; the Wayne County DPW; local government officials from project area communities; and interested citizens at a meeting arranged by the DPW. US-EPA also established a Citizens Advisory Committee to encourage the formulation of a "citizen viewpoint". An informal meeting of this group during July 1978 was attended by US-EPA to facilitate dissemination of technical material.

Many issues relevant to the preparation of the EIS for the Huron Valley Wastewater Control System project area have been discussed through these means or were recorded from various meetings and hearings in the past. Public agencies and individual citizens have expressed concern about the potential effects of the project on various aspects of the existing and future environment. The following list highlights many of the issues involved in this project:

- Existing water pollution problems in the project area resulting from inadequate wastewater treatment and failing septic tanks
- Impacts from construction of interceptor sewers on wetlands, parklands, possible archaeological and historic sites, and other sensitive areas
- Protection of the surface water supplies at Flat Rock and Monroe

- Present and future condition of Lake Erie
- Impacts on the Pointe Mouillee State Game Area
- Preservation of open space, prime farmland, and wildlife habitat
- Provision of adequate sewerage facilities to maintain community growth
- Compatibility of the project with SEMCOG goals for regional development
- Coordination of project area sewerage needs with the Detroit, Rouge Valley, and Downriver Wastewater Control Systems
- Evaluation of regional demographics and forecasted project area community population estimates
- Secondary impacts associated with growth which may be induced by the project
- Possible oversewering of the area
- Effects of eliminating WWTP discharge to the Walled Lake Branch and Lower Huron River during periods of low flow
- WWTP sludge treatment and disposal problems
- Effects of increased nonpoint source runoff from increased urbanization
- Potential constraints on future planning options from project implementation
- Resolution of debt retirement responsibility for WWTPs abandoned for regionalization
- Evaluation of local project cost-sharing and its impact on local government finance
- Additional consideration of land disposal of wastewater
- Energy and resource consumption
- Need to eliminate health hazards created by septic tank failures in Sumpter Township, and septic tank problem areas in Commerce and White Lake Townships
- Elimination of surcharging in Flat Rock sewer system
- Objection to a regional management agency controlling "local affairs"
- Downstream water quality degradation from expansion of Walled Lake WWTP in headwaters region
- High cost to individual homeowners from building local collection sewers

- Infrastructure planning has already anticipated regional wastewater system implementation
- More sewerage capacity to handle increased flows from existing population
- Elimination of the threat of local sewer connection bans
- Enforcement of industrial pretreatment requirements.

This document addresses these and other issues related to the implementation of a Huron Valley Wastewater Contol System.

# 2.0. NATURAL ENVIRONMENT

## 2.1. Atmosphere

### 2.1.1. Climate

The two major factors that control the climate of the project area are location with respect to major storm tracks and the influence of the Great Lakes. The normal wintertime storm track is south of Detroit. During the summer, most storms pass to the north, often causing brief showers in the project area. Occasionally heavy thunderstorms and/or damaging winds result. Climatic extremes usually are tempered by the Great Lakes. During the winter, arctic air masses moving across the Great Lakes are warmed and moistened. As a result, the intensity of cold air waves moving from the northern plains is reduced. Increased cloudiness and little sunshine are characteristic of winter in the project area.

The wind is usually from the west-southwest during the winter and from the southwest during the summer. The average wind speed is 10.3 miles per hour. In winter, snow flurries are caused throughout Michigan by winds from the northwest. The average snowstorm results in about 3.0 inches of accumulation, with larger amounts building up several times per year. Many of the large rainfalls during winter are associated with southeast winds, with the most substantial amounts occurring northwest of Detroit. Summer showers coming from the northwest tend to occur over a much larger area.

Precipitation is distributed relatively evenly throughout all months of the year, with the largest amount usually in June. The average amount of rainfall in the area of the proposed regional WWTP in Brownstown Township is about 2.5 inches for the month of June. The annual average at that site is about 25 inches, a low amount of rainfall for Wayne County (SEMCOG 1976a). In contrast, the annual average precipitation at the Detroit Metropolitan Airport is almost 32 inches, a more typical value for the Detroit area.

Temperatures average near the freezing point during the winter. Once or twice a year the temperature drops to near or slightly below zero degrees Fahrenheit (F). During the spring and autumn, temperatures are quite pleasant, reflecting an annual average temperature for the area of $49^{\circ}$ F. During summer, temperatures only occasionally reach $90^{\circ}$F. The highest temperatures often are accompanied by high humidities.

The growing season averages 180 days in length (23 April-21 October), with a maximum length of 205 days and a minimum of 145 days (from as late as 12 May to as early as 23 September). The waters of the Great Lakes exert a favorable influence on agriculture in the area, delaying both premature growth in the spring (before frosts are past) and freezing in autumn.

### 2.1.2. Air Quality

The project area is located in the Detroit -- Port Huron Air Quality Control Region, AQCR Number 123, which includes Macomb, Oakland, St. Clair, and Wayne Counties, Michigan. Because the proposed treatment plant site in Brownstown Township is located in the southeastern section of Wayne County which borders on Monroe County, the Monroe -- Toledo Interstate (Ohio and Michigan) AQCR (Number 124) also is considered herein.

Air pollution in southeastern Michigan primarily is attributable to the heavy industries located along both shores of interconnected waterways extending from Port Huron, Michigan, to Toledo, Ohio. The largest source of this pollution occurs along the west bank of the Detroit River from just southwest of downtown Detroit to opposite Grosse Ile, which is immediately north of the proposed wastewater treatment plant site in Brownstown Township. Although the amount of contamination is quite large, a regionally hazardous condition does not exist (relative to industrial areas located in valleys, etc.) owing to dispersion by horizontal and vertical air movements. The largest emitting sources in the project area are the Detroit Edison power plant, the McLouth steel mills at Trenton, and the Michigan Casting Center foundry located at Flat Rock.

Concentrations of particulates at seven of eleven air quality monitoring stations in and around the project area were in violation of the 150 $\mu g/m^3$ secondary (welfare-related) 24-hour particulate national ambient air quality standard. As a result, AQCR 123 has been designated a "non-attainment area" for secondary standards by US-EPA (published in the Federal Register 3 March 1978). The 260 $\mu g/m^3$ primary (health-related) standard was violated only at one site (at Frenchtown Township, a violation probably attributable to dust from open farmlands according to the MDNR-Air Quality Division). One excess of the standard per year is allowed (as occurred at Allen Park). At two stations, Allen Park and River Rouge, located in Wayne County about 12 to 15 miles north of the proposed regional WWTP site in southern Brownstown Township, the measured concentrations were in violation of the 75 $\mu g/m^3$ primary particulate standard. These violations reflect the localized pollution of the heavily industrialized Detroit and Dearborn areas, which include Allen Park and River Rouge. Thus, these two sites are not truly representative of the project area.

The five-year trend for TSP (total suspended particulates) in Wayne, Oakland, and Monroe Counties indicates that particulate concentrations appear to be declining. Monroe and Oakland Counties meet the 75 $\mu g/m^3$ annual primary particulate standard and Wayne County soon will be in compliance with this standard if the trend continues.

Data for the six sulfur dioxide monitoring stations within a 10-mile radius of the Brownstown Township site were in compliance with the $SO_2$ standards during 1976. All but one of the thirty $SO_2$ stations in Monroe, Oakland, and Wayne Counties were in compliance with the standards during both 1975 and 1976. At a site in southwestern Detroit, three excesses (two violations) of the 365 $\mu g/m^3$ 24-hour standard were recorded during 1976; however, the problem was due to a particular point source which now has implemented stricter controls.

All seven $NO_2$ monitoring sites in Monroe, Oakland, and Wayne Counties met the 100 ug/m3 annual standard during 1976. The highest annual arithmetic mean of 100 $\mu g/m^3$ was recorded at the Southfield and Lodge Expressways site in Oakland County. This high annual average is indicative of the motor vehicle emissions attributable to the heavy traffic on the expressways. It is not representative of the project area.

Carbon monoxide was measured at six stations in Wayne County and at one in Oakland County during 1976. The CO concentrations are highest at the two downtown Detroit stations, with a combined total of 91 excesses of the 10 $ug/m^3$ 8-hour standard (89 violations) recorded. The residential areas of the city experienced few CO standard violations, while no such violations occurred at the suburban sites.

Numerous violations of the photochemical oxidant (or ozone) standard were recorded at the three monitoring sites in Wayne and Oakland Counties. The oxidant problem is considered a national or regional problem rather than a local problem because of the large distances air contaminants (such as HC and $NO_2$) are transported as oxidants.

Odors are sometimes emitted from industrial processes in the project area. The existing sewage treatment facilities, however, have not posed significant odor problems. Mr. William McLin, Wayne County Air Pollution Control Division, reported that no complaints of odors from the existing wastewater treatment facilities at Brownstown, Flat Rock, Rockwood, and Trenton have been received (By phone, 22 November 1977).

There have been odor problems associated with the sludge handling and disposal (by incineration) at the Wyandotte WWTP. Most of the odors are released as the sludge (brought in from surrounding areas) is unloaded from tank cars and is placed into temporary storage prior to incineration.

### 2.1.3. Sound

A survey of ambient sound levels was conducted in the project area on 6 and 7 December 1977. In the area of the proposed regional WWTP, the measured $L_{eq}(24)$ ranged from 49 dBA to 53 dBA at three stations. Nighttime sound levels were slightly less than during the daytime. Daytime sound levels also were measured at two stations along the proposed interceptor route. Traffic accounted for the slightly higher sound level ($L_{eq}$ of 56 dBA) at one station, while the second station measured and $L_{eq}$ of 53 dBA. These levels are less than the Federal Highway Administration design noise level (60 dBA) for tracts of land in which "serenity and quiet are of extraordinary importance" (1973).

## 2.2. Land

### 2.2.1. Physiography and Topography

The project area is situated on a glacial plain which has been overlain by beach and lake deposits. The topography consists of an undulating plain which slopes gently to the southeast. A series of ridges and troughs extends northeast-southwest through the central part of the area and parallels glacial frontal moraines and former lake beaches (Enviro Control, Inc. 1976). The highest elevation in the project area is approximately 1,150 feet above msl (near the northern border of White Lake Township); the lowest about 519 feet above msl (at the silica pits in Brownstown Township).

## 2.2.2. Geology

### 2.2.2.1. Surficial Geology

During the past million years, Michigan experienced four stages of glaciation. The most recent stage was the Wisconsin Stage, which was responsible for the deposition of the unconsolidated sediments prominent in southeastern Michigan (Twenter 1975). The Wisconsin Stage consisted of three lobes: the Saginaw lobe, which advanced from the northwest; the Erie lobe, which advanced from the southeast; and the Huron lobe, which advanced from the northeast (Noyce 1974). The landforms and surficial formations of the project area were formed about 13,000 years ago by the ablation of these lobes (Twenter 1975).

The project region can be subdivided into three regions on the basis of surface geology: the Commerce Gravel Plain, the Defiance Moraine, and the Lake Plain Each region represents a different form of glacial deposition and is characterized by hydrologic and geologic properties.

#### Commerce Gravel Plain

The northwestern section of the project region is part of the Commerce Gravel Plain and is characterized by an irregular topography and a low relief of 10 to 40 feet per mile (Enviro Control, Inc. 1976). The topography of this region contains many closed depressions (kettles) which were formed by circumdeposition around stagnant ice blocks. These depressions are basins for many of the lakes and marshes in the area. Other geomorphic features include kames (hills of sand and gravel deposited directly from melting ice) and eskers (ridges of sand and gravel deposited by streams flowing under glacial ice). Kames and eskers are primary sources of commercial sand and gravel in the project region.

The glacial drift in the Commerce Region is composed of 150 to 300 feet of moraine and outwash deposits. Moraine deposits consist of unsorted, unstratified glacial debris which was deposited directly from the fronts of nearly static ice lobes. Outwash sediments, however, predominantly are stratified sands and gravels which were deposited by meltwaters flowing from receding glacial lobe fronts. Although grain size may vary considerably in outwash material, most of the fine silt and clay fractions have been removed by the meltwaters (Noyce 1974). Outwash sediment is generally more permeable than moraine material and may provide a valuable source of groundwater.

Clay till directly underlies outwash deposits throughout most of the outwash plain. It is relatively impermeable and serves as a bottom confining layer for unconfined surface aquifers (Noyce 1974). This clay aquiclude also acts as the top layer for underlying artesian aquifers.

#### Defiance Moraine

The central section of the project region is in the Defiance Moraine and has a relatively high relief of 50 to 125 feet per mile (Enviro Control, Inc. 1976). The Defiance Moraine is characterized by morainic hills and till plains of unsorted, unstratified glacial sediments. The morainic ridges tend northeast-southwest. The Huron River and the River Rouge have cut these ridges and have altered local topography.

Glacial drift in the Defiance region attains a maximum thickness of 400 feet and is dominantly moraine material (deposited at the front of a nearly static ice lobe) and ground moraine material (deposited at the front of a rapidly advancing or retreating ice lobe). Ground moraine and moraine sediments are highly variable in composition and may exhibit rapid vertical and horizontal changes in texture and permeability. They consist of unsorted clay, silt, sand, gravel, and scattered boulders (Noyce 1974). The Defiance Moraine also contains several linear deposits of sand which are important aquifers (Figure 2). The sand deposits probably were formed by glacial meltwater streams.

During the final stages of glacier retreat, localized areas of southeastern Michigan were inundated by water from a large glacial lake. Lake levels were controlled primarily by the position of the glacier as it retreated to the east and north. As the glacier retreated, morainal deposits were eroded and redeposited by the lake water (Twenter 1975).

### Lake Plain

The southeastern part of the project region is part of the lake plain formed by a large glacial lake. The lake plain slopes gently to the southeast. Although relief in river valleys may be as much as 45 feet per mile, relief in interfluvial areas rarely exceeds 20 feet per mile (Enviro Control, Inc. 1976).

Glacial lake clays are compact gray clays which are weathered to yellow or brown near the surface. They vary in thickness from 10 to 20 feet near the mouth of the Huron River to more than 100 feet at the western limit (defined by the Defiance Moraine). Near the mouth of the Huron River, lake clays are separated from the bedrock by a veneer of sand and sandy gravel. Where drainage is poor, lake clays are overlain by as much as 2.0 feet of organic soil and muck (Enviro Control, Inc. 1976).

In addition to clay and sandy clay, the glacial lake plain contains fine to coarse-grained materials which have been sorted by running water and wave action (Giffels/Black & Veatch 1977a). Glacial lake dunes, beaches, and sand bars consist of sediments ranging from fine sand to coarse gravel. In sandy lakebed regions of Sumpter Township (Figure 2), 35 to 65 feet of basal clay are overlain by 5 to 25 feet of sand (Wayne County Department of Health 1974).

### 2.2.2.2. Bedrock Geology

In the project region 3,000 to 6,000 feet of Paleozoic sedimentary rocks overlie crystalline Precambrian rocks (Twenter 1975). The regional dip for Paleozoic rocks in southeastern Michigan is approximately 35 feet per mile to the northwest. The consistency of dip, however, is modified by local flexures such as the Howell and Freedom anticlines.

The bedrock surface in the project region has a southeasterly slope which is interrupted by a north-south trending ridge. Preglacial drainage appears

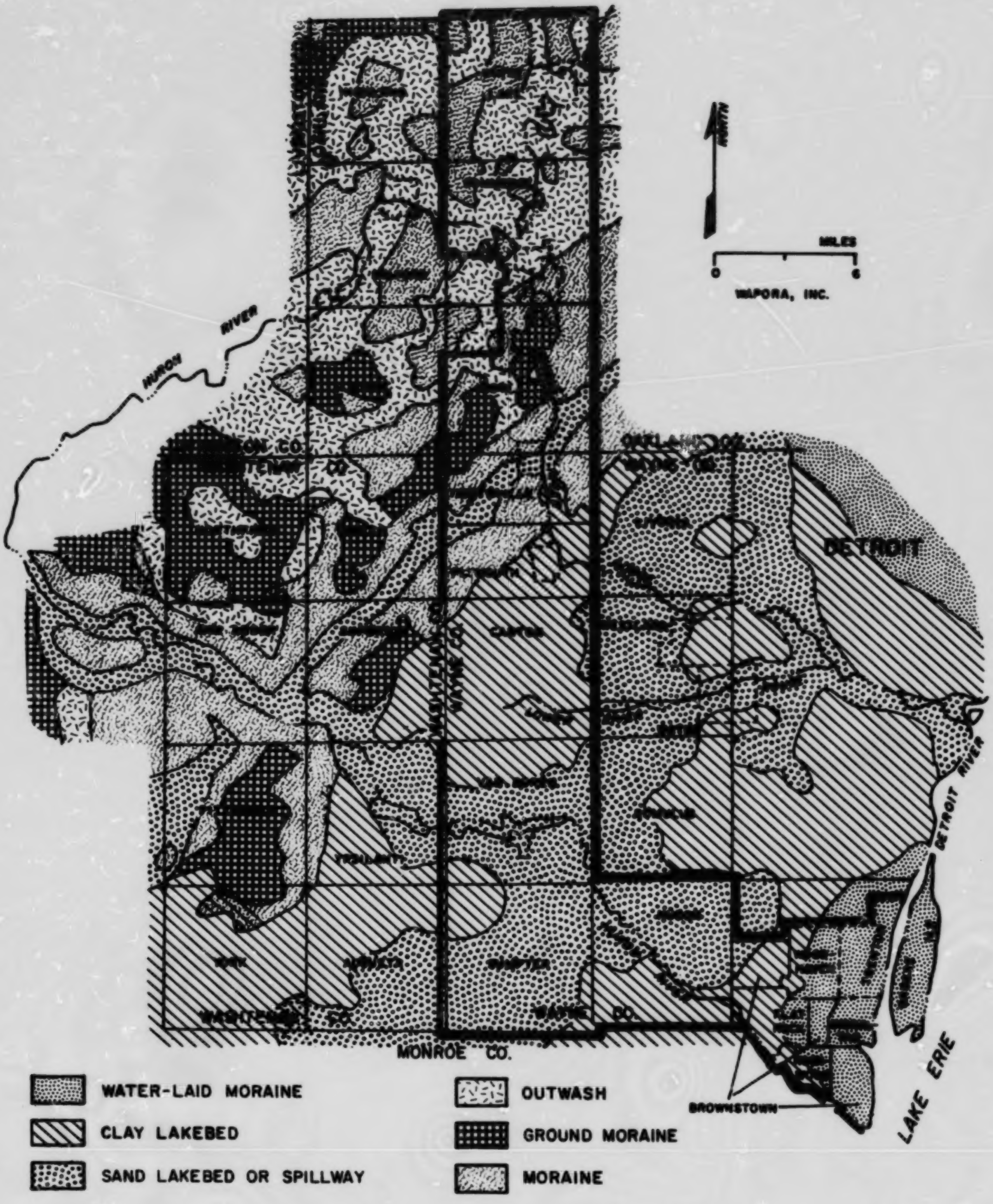

NORTH
MILES
0
6
WAPORA, INC.
HURON RIVER
OAKLAND CO.
WAYNE CO.
DETROIT
DETROIT RIVER
WASHTENAW CO.
MONROE CO.
LAKE ERIE
BROWNSTOWN
WATER-LAID MORAINE
CLAY LAKEBED
SAND LAKEBED OR SPILLWAY
OUTWASH
GROUND MORAINE
MORAINE

Figure 2. Glacial (surface) geology of the Huron Valley project region (Adapted from SEMCOG 1976b).

to be to the south and southeast. Nine rock units outcrop beneath glacial drift in southeastern Michigan. These include the Coldwater Shale, Sunbury Shale, Berea Formation, Bedford Shale, Traverse Group, Dundee Formation, Detroit River Group, Antrim Shale, and the Sylvania Sandstone.

### 2.2.3. Soil

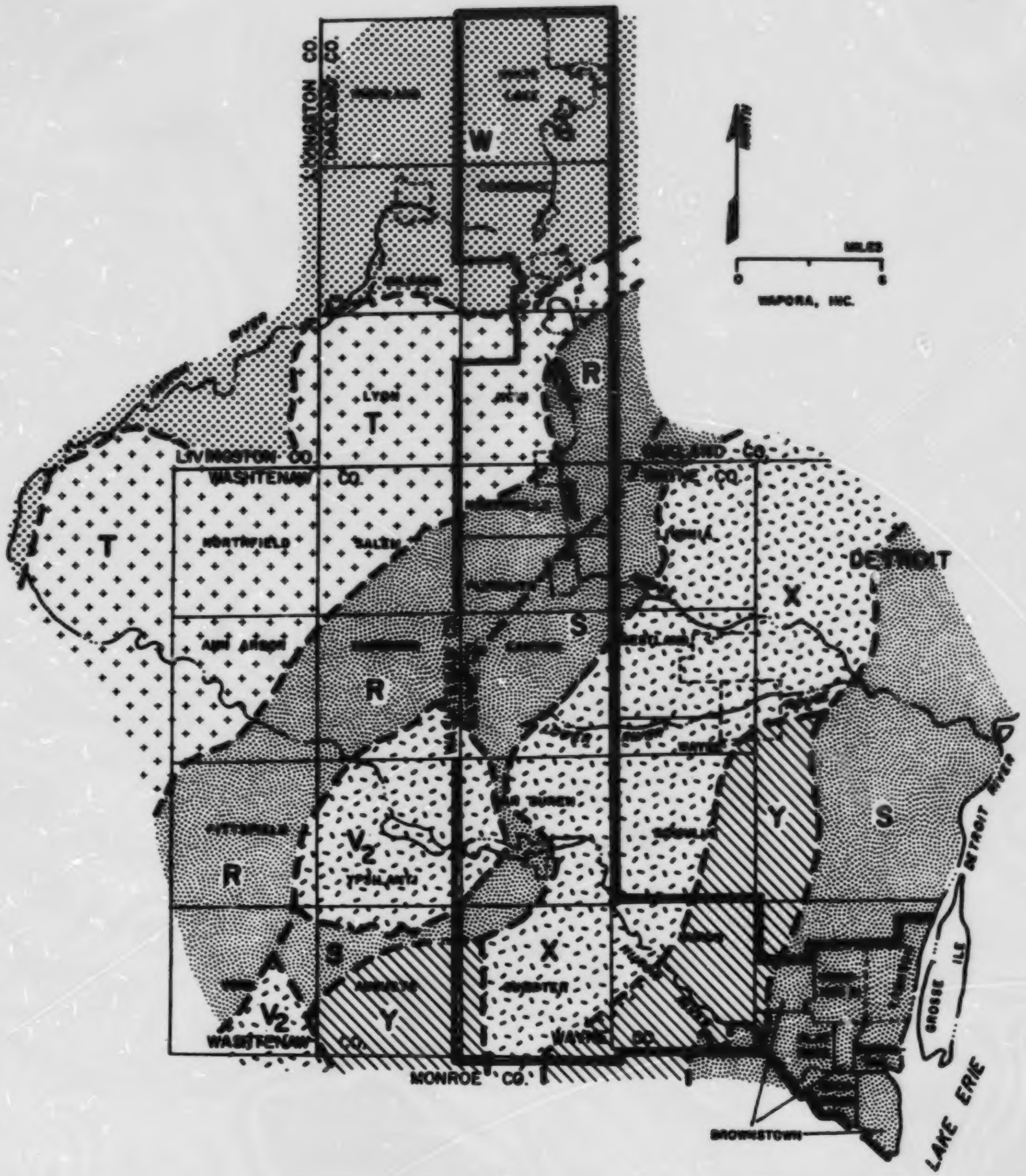
The character of the soil in the project region is controlled primarily by the parent material and by the landforms on which they developed. The primary soil types in the project region and their infiltration rates are depicted in Figure 3.

The characteristic soils developed on moraines and kames are the Hillsdale, Bellefontaine, and Colona soils. Colona soils are well drained deep sands which are relatively low in porosity and subject to wind erosion when ground cover is removed (Noyce 1974). The major soils which have developed on steep slopes of granular-cohesive till deposits are the Miami and Hillsdale soils. These are well drained loams and sandy loams with moderate to poor internal drainage. The St. Clair (well and moderately well drained clay) and Blount soils (somewhat poorly drained clay loam and silty clay loam) also are prevalent in morainal regions (Twenter 1975).

Owing to rapid runoff on steep slopes and poor internal drainage of deposits, morainal regions often contain large bodies of standing water. Washtenaw and Wallkill soils form in these wet depressions and consist of wash material from adjacent slopes. Flat ground moraine regions contain moderate to poorly drained granular cohesive deposits. Predominant soils in these areas are Conover, Brookston, and muck. Some muck deposits exceed 30 feet in depth (Noyce 1974). The organic soils and coarse to moderately coarse textured soils of Novi and Commerce Townships are acidic (having a pH of 5.5 or less) and are highly corrosive to concrete (Giffels/Black & Veatch 1977a).

In primarily outwash regions, soils become more granular with some areas having thin stratified sands overlying clay till. The dominant soil types are Locke sandy loams, Oshtemo well drained loamy sands (Noyce 1974), and Boyer well to moderately well drained loamy sands (Twenter 1975). Soils associated with outwash deposits are highly permeable and may cause seepage and dewatering problems in open excavations and trenches during construction (Larson and others 1975; Giffels/Black & Veatch 1977a).

Soils of lake plains are mostly poorly drained with textures ranging from fine to coarse (Giffels/Black & Veatch 1977a). Infiltration rates range from 1.0 inch per hour to over 12 inches per hour (Larson and others 1975; and Knutilla 1971). A map of soil management groups for Wayne County (SEMCOG n.d.) depicts the following soil types for sand lakebed and spillway regions: Granby (poorly and very poorly drained sand with moderate to strong subsoil development), Tedrow (somewhat poorly drained sand with moderate to strong subsoil development), Thetford (somewhat poorly drained loamy sand), Fox (20 to 40 inches of well drained sandy loam over sand and gravel), Oshtemo (well drained loamy sand), and Spinks (well and moderately well drained loamy sand). Soils of highly permeable regions include Granby, Tedrow, Thetford, Selfridge (20 to 40 inches of somewhat poorly drained, loamy sand over loam to silty clay loam), Pewamo (poorly and very poorly drained clay loam and silty clay loam), and Corunna (20 to 40 inches of poorly and very poorly drained sandy loam over loam to silty clay loam).


W
R
T
S
X
Y
$V_2$
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
NORTHFIELD
SALEM
ANN ARBOR
PITTSFIELD
YPSILANTI
LYON
DETROIT
DETROIT RIVER
GROSSE ILE
MONROE CO.
BROWNSTOWN
LAKE ERIE
MILES
0
6
WAPORA, INC.

| Letter Symbol | Pattern Symbol | Infiltration Rate (inches/hour) | Soil Types |
|---|---|---|---|
| R | ▓ | 1 to 2 | St. Clair, Blount, Miami, Hillsdale |
| S | ▒ | 1 to 2 | Brookston, Blount, Hoytville, Toledo, Colwood |
| T | ⁘ | 2 to 4 | Miami, Conover, Bellefontaine, Hillsdale, Boyer, Colona, Brookston |
| $V_2$ | ░ | 4 to 8 | Fox, Oshtemo |
| W | ▒ | 8 to 12 | Bellefontaine, Hillsdale, Boyer, Colona, Locke, Oshtemo |
| X | ░ | 4 to 8 | Berrien, Wauseon, Granby, Tedrow, Thetford, Fox, Oshtemo, Spinks |
| Y | ▨ | 12+ | Plainfield, Newton, Ottawa, Granby, Tedrow, Thetford, Selfridge, Pewamo, Corunna |

Figure 3. Minimum infiltration rates and soil associations in the Huron Valley project region. Infiltration rates have been adapted from Larson and others 1975, Twenter 1975, and Knutilla 1971. Soils data are taken from Noyce 1974 and SEMCOG n.d.

Twenter (1975) notes the following soil groups for clay lakebed areas: Brookston (poorly drained loam and silt loam), Blount (somewhat poorly drained, clay loam and silty clay loam), Hoytville (poorly and very poorly drained clay), and Colwood (poorly and very poorly drained loam and silt loam). Soils in clay lakebed areas may exhibit high shrink-swell potential. Extensive shrinking and swelling due to changes in moisture content may result in the rupture of sewer lines and building foundations (Giffels/Black & Veatch 1977a).

Classification of soils as to land capability is important for distinguishing potential agricultural productivity, limitations to use, and management problems. Criteria for capability classifications include slope, soil texture, effects of past erosion, permeability, water-holding capacity and other features.

Soils are grouped into eight established capability classes, with the risk of soil drainage or limitations becoming progressively greater from Class I to Class VIII. Soils in Classes I through IV are capable, under good management, of long-term sustained production of adapted crops. Numerous parts of the project area, especially in the western townships, have soils which have been designated Class II type farmlands. These lands are recognized under the USDA Soil Conservation Service (SCS) criteria as "prime farmland" (43 FR 4030).

Information obtained from the Oakland County Soil and Water Conservation District (By letter, Mr. James L. Reid, 31 January 1978) indicates that a substantial portion of Novi meets the criteria for prime farmlands. Major soils in this category include Capac, Matherton, Metamora, Brookston, Colwood, Sebewa, some Marlette, Owosso, Riddles, Fox, and Sisson. Fewer areas of White Lake and Commerce Townships were noted as Class II prime farmlands. Soil series in Class II for those townships include Marlette, Fox, Riddles and some Capac, Matherton, Brookston, and Colwood.

A soil survey of Wayne County was completed in November 1977 by the SCS. The following soil series were identified as prime farmlands (By letter, Mr. Charles S. Fisher, Michigan State Soil Scientist, 14 February 1978):

- Blount loam, 0 to 4 percent slopes
- Blount-Pewamo loams, 0 to 2 percent slopes
- Corunna fine sandy loams
- Hoytville silty clay loam
- Kibbie fine sandy loam, 0 to 3 percent slopes
- Metamora sandy loam, 0 to 3 percent slopes
- Metamora-Pewamo complex, 0 to 3 percent slopes
- Morley loam, 2 to 6 percent slopes
- Owosso-Morley complex, 2 to 6 percent slopes
- Pella silt loam
- Pewamo loam
- Shoals silt loam.

### 2.2.4. Terrestrial Vegetation

Existing vegetation in the project area was mapped by SEMCOG as part of their Land Use/Land Cover mapping program for the Southeastern Michigan region. Based on these maps, the following descriptions of existing project area vegetation types were developed.

#### 2.2.4.1. Woodlands

Woodlands are classified as areas with 30% or more crown closure. Woodlands are scattered throughout the project area. Most stands, including the oldest ones, are found in parks and along waterways. Stands of virgin timber are very scarce in this area. Four woodland-types were observed in southeastern Michigan: oak-hickory forest, maple-beech forest, mixed hardwoods forest, and hemlock-white pine-northern hardwoods forest.

##### Oak-Hickory Forest

Oak-hickory forests are found predominantly on drier soils, however, they often occur on the margins of wetter sites. The dominant species are white, black, and northern red oaks. Bitternut and shagbark hickory are common. A mixture of sugar maple, black cherry, basswood, and hackberry often is present in the subcanopy.

One conspicuous feature of oak-hickory forests is the abundance of shrubs in the understory/undergrowth. Shrubs in this forest-type include red-stemmed dogwood, blueberry, and hazelnut, and thorny species such as prickly ash, gooseberry, and blackberry.

##### Maple-Beech Forest

Sugar maple and American beech are the most common trees in the canopy. A nearly closed canopy usually is formed in mature stands which greatly restricts the amount of light penetrating into the understory. Small canopy openings, resulting from the death of a few trees, favor the reproduction and growth of shade-tolerant species such as maples, beech, and hop-hornbeam. The growth of shade-intolerant species such as northern red oak, black cherry, basswood, and elm is favored when canopy openings are more extensive.

##### Mixed Hardwood Forests

Numerous species of trees occur in mixed hardwood forests. These forests often are found on poorly drained lowland areas that are flooded during spring. Boxelder, red maple, silver maple, slippery elm, yellow birch, large-toothed aspen, northern red oak, and white and green ashes are common. Cottonwood, shagbark and mockernut hickories, sycamore, prickly ash, and swamp white oak also may be present.

A variety of rose species, along with red osier, flowering dogwood, hop-hornbeam, staghorn sumac, black haw, buckthorn, and common blackberry occur throughout the shrub stratum. Herbaceous plants include meadowsweet, hardhack, aster, and Queen Anne's lace.

### Hemlock-White Pine-Northern Hardwood Forests

The hemlock-white pine-northern hardwood forest is favored on loamy or clay-loam soils in cool, moist climates that exist near the northern border of the project area. Virgin or near-virgin tracts of forest are small and occur as isolated stands interspersed between secondary forests. Species characteristic of the northern hardwood forest are hemlock, yellow birch, sugar maple, basswood, and white ash. American elm was a major component of this forest until the 1960s when the Dutch elm disease spread throughout the area. Subdominant tree species include paper birch, red maple, American elm, northern red oak, and hop-hornbeam.

In general, the understory is sparse. Shrubs are not abundant, and include sumac, red osier, red-panicled dogwood, and leather-leaf. Herbaceous plants are uncommon in mature hemlock-hardwood forests. Canadian mayflower may be common locally as well as ground pine.

### 2.2.4.2. Brushland and Grasslands

Brushlands in the project area are composed of assemblages of patchy to continuous shrub growth. Vegetation of this type frequently represents a response to large-scale disturbance of forested land. Dry upland soils covered predominantly with shrubs and underbrush, and railroad rights-of-way also are included in this category. The majority of areas designated as grassland areas in this region are managed and are subject to periodic mowing. As a result the diversity of plant life is restricted. These areas include pasture, deserted cropland, golf courses, field and picnic areas, and cemeteries.

### 2.2.4.3. Agricultural Land

A large percentage of land in the project area is used for agricultural purposes. Approximately 32% of the land in Oakland and Wayne Counties is under cultivation (SEMCOG 1976c). The crops most commonly grown in this area are corn, oats, soybeans, wheat, barley, potatoes, field beans, and sugar beets. Other crops include tomatoes, mushrooms, celery, dry beans, sweet corn, fruits, and sod.

### 2.2.4.4. Wetlands

Wetlands are the poorly-drained areas that are transitional between dry land and open water. Seasonal and yearly variations in the borders of wetlands often make it difficult to define these areas. Phreatophytes are the most common plant form in project area wetlands. Many of the species included in this group such as large-toothed aspen, cottonwood, willow, alder, cattail, bulrush, and various mosses have little economic value. As a whole system, however, wetlands function as a valuable resource. Wetlands affect the quality of water by absorbing and storing nutrients from upland runoff and in these areas also influences the quantity to water by acting as a reservoir during dry periods and retarding water flows during flood periods. Wetland vegetation types also provide essential breeding, nesting, resting, and feeding grounds, and predator-escape cover for a diverse group of invertebrates, fish, reptiles, birds, and mammals. Recreational use and land development in the project area have diminished the number and extent of wetland areas and have altered the natural structure and composition of the vegetation.

### 2.2.4.5. Endangered, Threatened, and "Rare" Vascular Plants

None of the vascular plant species in the project area are included in the Federal list of endangered and threatened species (50 CFR 17). No vascular species within the project area has been determined to be endangered according to the Michigan Endangered Species Act. Table 1 lists species which are considered threatened according to Michigan's Endangered and Threatened Species Program which potentially may occur within the project area. The data are not specific enough to determine exact locations, but general habitat requirements are identified.

### 2.2.5. Wildlife

Wildlife constitute an important natural resource. Game species are valuable to hunters and trappers. Non-game species often have aesthetic value and may act as natural controls on animal pests. The 1975 Great Lakes Basin Framework Study (GLBC 1975a) noted that the demands on wildlife had exceeded the available supply. The constant increase in human population levels with concomitant decreases in wildlife habitats pose a serious problem.

The project area includes a wide range of habitats (Section 2.2.4.). Much of the area includes active and vacant agricultural lands and wooded areas. Urban and suburban development are common in the southeast section of the project area. To the west and north, the landscape changes from its flat semi-rural character to a rolling topography with numerous lakes and wetlands, small wooded areas, and scattered farmland. Throughout the project area the suburban nature of much of the region tends to limit the number of some animals. They are unable to coexist with human activities, even though otherwise suitable habitats are available. The most diverse and abundant wildlife populations appear to be those associated with wetland areas (Enviro Control, Inc. 1976). Wetlands are of moderate to high value for waterfowl production (Michigan Department of State Highways 1976). Amphibian, reptile, and mammal species also are numerous in and near marshes, swamps, and bogs. The marsh area of the Pointe Mouillee State Game Area furnishes habitats for many species of wildlife and fish (Enviro Control, Inc. 1976).

### 2.2.5.1. Amphibians

The Class Amphibia includes frogs, toads, and salamanders. They are "cold-blooded", and control their body temperatures by moving to cooler or warmer environments as necessary (Conant 1975). There are 19 amphibians which potentially may occur in the project area. They include commonly known species such as the bull frog, northern leopard frog, American toad, and gray treefrog.

Table 1. Threatened species of vascular plants potentially occurring in the Huron Valley Wastewater Control System project area, Michigan (Wagner and others 1977).

| Scientific Name | Common Name | Comments |
|---|---|---|
| LILIACEAE | | |
| *Camassia scilloides* | Wild hyacinth | Prairies and moist open woods |
| POACEAE | | |
| *Zizania aquatica* var. *aquatica* | Wild rice | Marshes and shallow water |
| *Zizania aquatica* var. *interior* | Wild rice | Marshes and shallow water |
| ORCHIDACEAE | | |
| *Habenaria leucophaea* | Prairie fringed orchid | Bogs and marshes |
| ACANTHACEAE | | |
| *Justicia americana* | Water willow | Mud and shallow water |
| ARISTOLOCHIACEAE | | |
| *Aristolochia serpentaria* | Virginia snake root | Moist or dry upland woods |
| ASTERACEAE | | |
| *Silphium perfoliatum* | Cup-plant | Woods and low ground |
| FABACEAE | | |
| *Gymnocladus dioica* | Kentucky coffee tree | Rich moist woods |
| MALVACEAE | | |
| *Hibiscus palustris* | Swamp rose-mallow | Coastal |
| ONAGRACEAE | | |
| *Gaura longiflora* | Gaura | Marshes |
| *Ludwigia alternifolia* | Seedbox | Swamp and wet soils |
| RANUNCULACEAE | | |
| *Hydrastis canadensis* | Golden seal | Rich woods |

### 2.2.5.2. Reptiles

The Class Reptilia includes snakes, lizards, turtles, and alligators. They are "cold-blooded" and are covered by scales or bony plates (Elliott 1968). There are 28 reptiles which potentially may occur in the project area. They include commonly known species such as the common snapping turtle, the eastern garter snake, the blue racer, and the eastern massasauga.

### 2.2.5.3. Birds

Over 300 different species of birds have been observed in or near the project area (Giffels/Black & Veatch 1977b). Celeron Island in the lower Detroit River and Pointe Mouillee are important waterfowl areas (GLBC 1975a). Birds frequently seen in the project area include the cardinal, blue jay, crow, starling, red-wing blackbird, mallard, and bobwhite.

### 2.2.5.4. Mammals

The Great Lakes region is a transitional area for many mammal species (Burt 1957). Common mammals which are among the 56 which may occur in or near the project area include the raccoon, eastern cottontail rabbit, fox squirrel, opossum, and red fox.

### 2.2.5.5. Endangered and Threatened Animals

One amphibian, three reptiles, eleven birds, and six mammals which potentially may be found in or near the Huron Valley project area are included on the State list of threatened and/or endangered species. Four of these species also are on the Federal list. The animals listed by the State as imperiled are listed below. Species also on the Federal list are marked with an asterisk.

| Common Name | Scientific Name |
|---|---|
| Amphibians | |
| (T) Small-mouthed salamander | *Ambystoma texanum* (Matthes) |
| Reptiles | |
| (T) Black rat snake | *Elaphe obsoleta obsoleta* (Say) |
| (T) Kirtland's water snake | *Natrix kirtlandi* (Kennicott) |
| (T) Eastern box turtle | *Terrapene carolina carolina* (Linnaeus) |
| Birds | |
| *(E) Peregrine falcon | *Falco peregrinus* (Tunstall) |
| *(E) Kirtland's warbler | *Dendroica kirtlandii* (Baird) |
| (T) Double-crested cormorant | *Phalacrocorax auritus* (Lesson) |
| (T) Cooper's hawk | *Accipiter cooperi* (Bonaparte) |
| (T) Red-shouldered hawk | *Buteo lineatus* (Gmelin) |
| (T) Bald eagle | *Haliaeetus leucocephalus* (Linnaeus) |
| (T) Marsh hawk | *Circus cyaneus* (Linnaeus) |
| (T) Osprey | *Pandion haliaetus* (Linnaeus) |
| (T) Piping plover | *Charadrius melodus* (Ord) |
| (T) Barn owl | *Tyto alba* (Scopoli) |
| (T) Loggerhead shrike | *Lanius ludovicianus* (Linnaeus) |

| Common Name | Scientific Name |
|---|---|
| **Mammals** | |
| *(E) Indiana bat | *Myotis sodalis* (Miller and Allen) |
| *(E) Eastern timber wolf | *Canis lupus lycaon* (Schreber) |
| (T) Least shrew | *Cryptotis parva* (Say) |
| (T) Pine marten | *Martes americana* (Turton) |
| (T) Southern bog lemming | *Synaptomys cooperi* (Baird) |
| (T) Pine vole | *Microtus pinetorum* (Le Conte) |

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(T) Threatened
(E) Endangered

## 2.3. Water

### 2.3.1. Surface Water

#### 2.3.1.1. Setting and Flow

The project area includes parts of the Huron and River Rouge basins, the lower Detroit River basin, and the western basin of Lake Erie (Figure 4). The northern section of the project area in Oakland County has numerous inland lakes and there are impoundments on the Middle River Rouge and Huron River in the project area.

The quantity of flow in the rivers and streams of the project area is determined by the amount of overland runoff from precipitation events, from water entering the streams from groundwater flow, and from wastewater discharged to the streams. Stream flow is usually highest in late winter and spring because of increased runoff, and lowest in late summer and fall when the least amount of precipitation occurs. Stream flow has been altered by the emplacement of hydraulic control structures at numerous locations on the Huron and Middle River Rouge systems. Flow also has been obstructed by encroachment onto the rivers' flood plains through the placement of fill and the addition of bridges.

#### Upper Huron River

The Huron River originates in Big Lake in west-central Oakland County (Figure 4) and flows to the southeast through the Huron Swamp. The river enters the northern section of the project area upon crossing into White Lake Township from the north.

Flow in this upper reach is measured by the US Geologic Survey (USGS) at Commerce Road Bridge (USGS 1976). Average discharge over 29 years of record at the station is 37.7 cfs. The maximum recorded discharge is 266 cfs (1947) and the minimum is 3.3 cfs(1971). The drainage area above this gage is 57.3 square miles.

There are a significant number of lakes along the main-stem river in White Lake and Commerce Townships: Pontiac Lake, Oxbow Lake, Cedar Island Lake, Mud Lake, Fox Lake, Commerce Lake, and Proud Lake. The lakes and the wetlands along the upper river's main channel serve to attenuate peak river

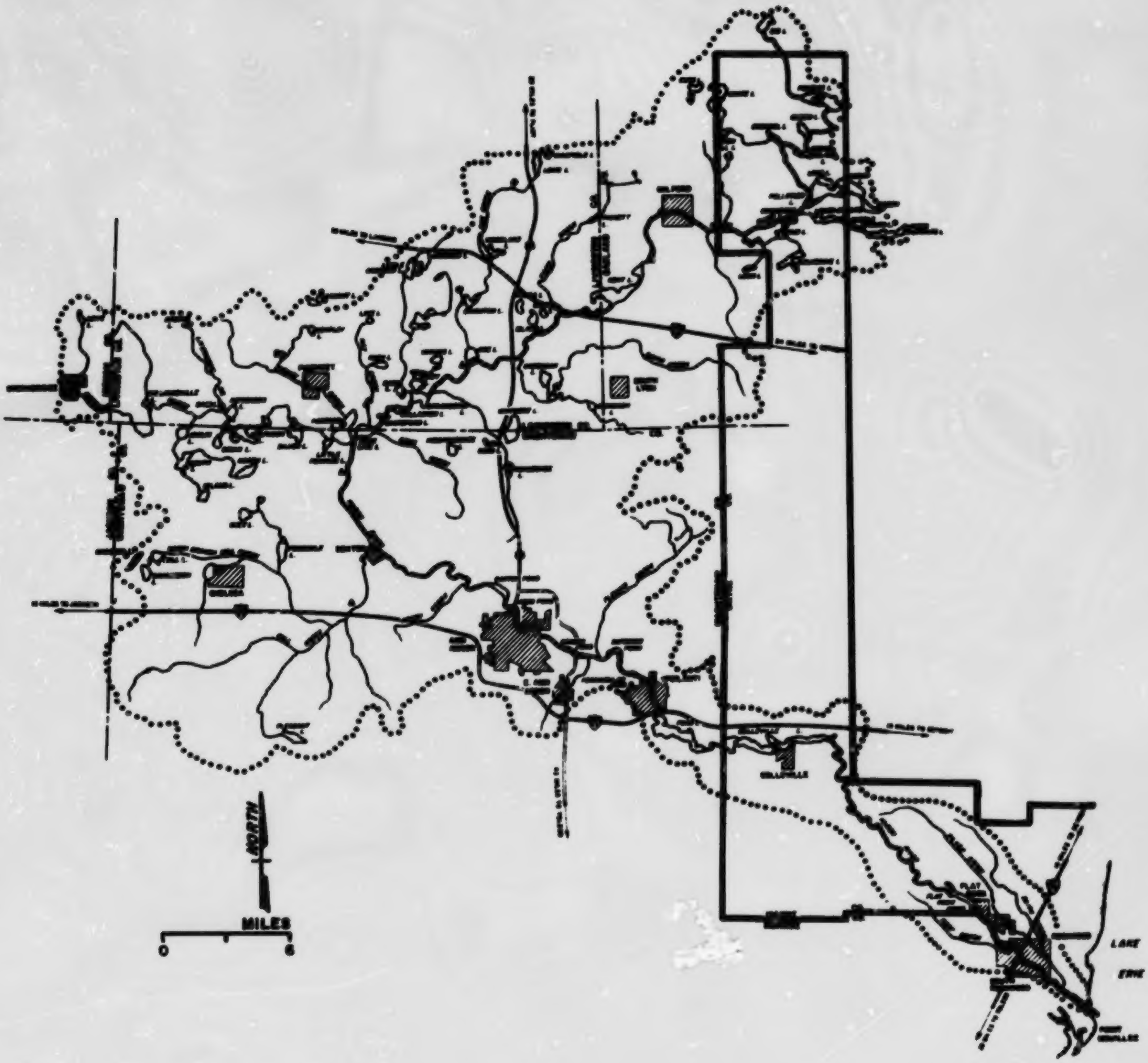
NORTH
MILES
0
6
LAKE
ERIE

Figure 4. The Huron River basin, Michigan (Adapted from MDNR 1977a).
The project area is indicated by heavy black line.

flows by holding storm water runoff in temporary storage. In extreme wet weather situations, flooding of shoreline development and fields has occurred due to increased lake levels (Knutilla 1972a).

The river leaves the northern section of the project area as it flows westward out of the Proud Lake State Recreation Area and crosses into Milford Township. Flow in this reach is measured at the USGS Gage Station at the General Motors Road Bridge just west of Milford (USGS 1976). At this point the drainage area is 132 square miles. The average discharge over 27 years of record is 97.0 cfs. The maximum recorded discharge is 645 cfs (1950) and the minimum, 5.2 cfs (1971).

### Lower Huron River

The Huron River reenters the project area at the head of Belleville Lake, about 70 river miles downstream from where it left the northern part of the project area west of Commerce. At this point the river has increased considerably in volume of flow and varies in width from 50 feet to 0.5 mile. The watershed of the Lower Huron River between Belleville Lake and the river's mouth at Lake Erie (near Pointe Mouillee) is relatively narrow. Of the total 908 square-mile area of the Huron River watershed, 833 square miles drain to the river upstream from Belleville Lake (Knutilla 1972a).

Belleville Lake is nearly 8 miles long and was formed in 1925 by the construction by Detroit Edison of the French Landing Dam as a hydroelectric power project (SEMCOG 1978a). Approximately 18 river miles downstream from this impoundment is a lowhead dam at Flat Rock. The Flat Rock Dam is owned by the City of Flat Rock and originally was used for electric power generation purposes. Neither of these power generation facilities are operational now.

The nearest river flow gage is the USGS gage approximately 22 miles upstream from the French Landing Dam at Ann Arbor (drainage area above gage is 736 square miles). The average flow of record at this point is 454 cfs, an increase of more than eleven times the average flow of the river in the northern part of the project area at Commerce. Flow in the Lower Huron River is regulated by the discharge from the French Landing Dam, and to a lesser extent by the dam at Flat Rock.

Ten-year, 7-day low flow values for the lower reach of the Huron River have been calculated for purposes of water quality planning. At Belleville Lake, a value of 77 cfs has been computed (McNamee, Porter, and Seeley 1975). The Michigan Department of Natural Resources is utilizing a value of 64 cfs in formulating wastewater discharge permit limitations downstream from the French Landing Dam.

Flooding occurs at several locations in the lower Huron Valley from Flat Rock to the mouth. Lowland areas near the river in Flat Rock and South Rockwood have suffered flood damages in the past. The maximum flood of record at the Ann Arbor gage was 5,840 cfs. Large floods also occurred in 1947 and 1968 (GLBC 1975b).

## Middle River Rouge

The Walled Lake Branch rises in swamplands south of Walled Lake in north Novi (Oakland County). The Walled Lake Branch flows generally south through the central part of the project area to its confluence with Johnson Drain in Northville. At this point, the stream becomes known as the Middle River Rouge (Figure 5 ).

Flow in the Walled Lake Branch is intermittent, with no flow occurring during sustained dry weather conditions. Continuous flow occurs downstream from Northville in the Middle River Rouge. A flow of less than 1 cfs occurred upstream from Plymouth in 1949 (Enviro Control, Inc. 1976).

Downstream from Northville are several main-stem impoundments: Waterford Pond, Phoenix Lake, Wilcox Lake, and Newburgh Lake. Much of this reach of the river is scenic and lies within the Middle Rouge Parkway and Riverside Park.

The Middle River Rouge flows out of the project area to the east, with the eastern project area boundary transecting Newburgh Lake. The confluence of the Middle Rouge with the main-stem River Rouge is approximately 14 miles downstream from Newburgh Lake.

The USGS maintains a continuous record of the flow of the Middle River Rouge at its gage station at Garden City, downstream from the bridge on Inkster Road. This point is approximately 8.0 miles downstream from where the river leaves the project area at Newburgh Lake. The drainage area in the basin upstream from the gage station is 100 square miles, compared to 62 square miles above Newburgh Lake, causing flow measured at this gage to be somewhat larger than is experienced within the project area. The average discharge recorded at the gage for the period of record is 69.1 cfs, with a maximum of 2,330 cfs and a minimum of 0.9 cfs. The 7-day, once in 10-year drought flow at the mouth of the Middle Rouge is reported as 4.5 cfs by the Michigan Department of Natural Resources (1974). At the Garden City gage station, this value is estimated to be 3.75 cfs (Enviro Control, Inc. 1976). Channel capacity of the river is small, which allows occasional overbank flooding to occur during peak flows (GLBC 1975b).

## Lower River Rouge

The Lower River Rouge has its headwaters in swamplands in eastern Washtenaw County, north of Ypsilanti. It flows eastward into the project area, entering Wayne County in Canton Township, and leaves it upon flowing into Wayne (Figure 5). The latter point is approximately 13 miles upstream from the river's confluence with the main-stem River Rouge.

The Lower River Rouge in the eastern part of Canton Township is bordered by the Lower Rouge Parkway. The river banks throughout this upper reach are largely undeveloped, maintaining the river's natural character.

Flow on the Lower River Rouge is recorded at the USGS gage at Inkster (John Daly Road Bridge), 9.0 river miles downstream from the project area's

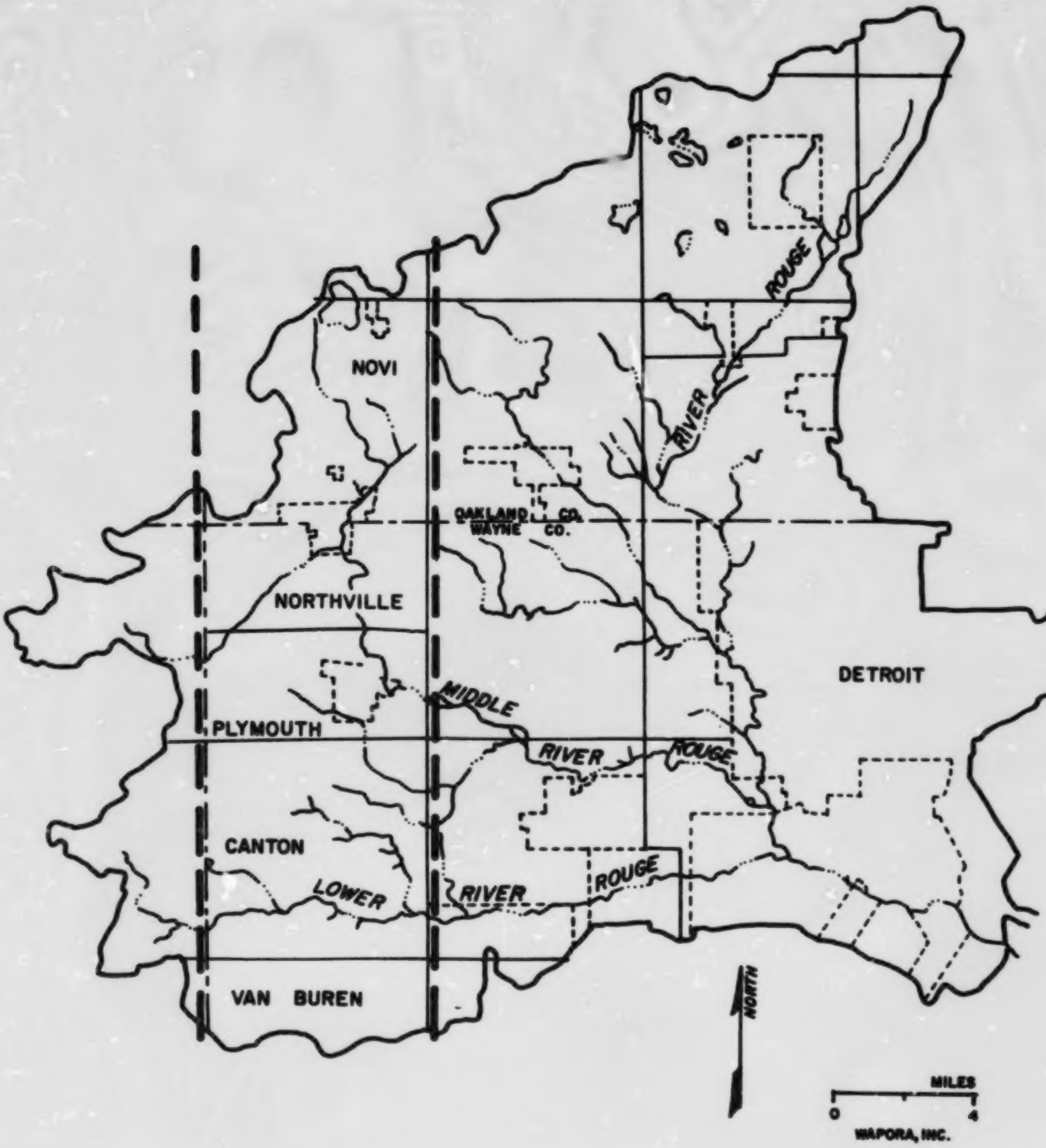
NOVI
OAKLAND CO.
WAYNE CO.
NORTHVILLE
PLYMOUTH
CANTON
VAN BUREN
DETROIT
RIVER ROUGE
MIDDLE RIVER ROUGE
LOWER RIVER ROUGE
NORTH
MILES
0
4
WAPORA, INC.

Figure 5. The River Rouge basin, Michigan (Adapted from SEMCOG 1978b). A section of the Huron Valley project area is indicated by the solid double lines.

eastern boundary (Canton Township - Wayne boundary line). The drainage area contributing to stream flow at the gage is 83 square miles compared to 55 square miles where the stream leaves the project area (Knutilla 1972b). Average flow recorded at the gage for the Lower River Rouge is 51 cfs, with a maximum flow of record of 3,600 cfs and a minimum of 0.2 cfs. It is reported that the river within the project area has had occasional periods of no flow during prolonged dry weather (Enviro Control, Inc. 1976). The Michigan Department of Natural Resources estimated 7-day, once in 10-year drought flow at the mouth of the Lower River Rouge to be 0.9 cfs (1974). The value calculated for the river at the gaging station at Inkster is 0.6 cfs (Enviro Control, Inc. 1976). Because of the limited amount of channel capacity, the Lower Rouge occasionally overflows its banks during periods of high flow (GLBC 1975b).

### Inland Lakes

White Lake Township and Commerce Township in Oakland County, in the northern section of the project area, contain many inland lakes. Some of these lakes originally were formed as kettle lakes following the Wisconsin glacial period (Section 2.2.2.). Some were created by artificial means. Because of their attractiveness and inherent recreational potential, much of the area surrounding these lakes is intensely developed. Some of these lakes have public swimming beaches.

### Detroit River - Lake Erie

The 32-mile-long Detroit River conveys the flow of the upper Great Lakes from the southwest part of Lake St. Clair to the northwestern arm of Lake Erie. This flow amounts to 93% of the total tributary flow to Lake Erie (GLBC 1975c).

The river averages 0.5 mile in width, but broadens to over 3.0 miles near its mouth. The river varies in depth from 27 to 50 feet. The lower 19 miles of river from the head of Fighting Island to Lake Erie has many islands created by an extensive limestone outcrop. An improved navigation channel is maintained through the lower river on the west side of Fighting Island and the east side of Grosse Ile (GLBC 1975c). The Detroit River serves as the border between the United States and Canada, and the river banks are intensely developed for residential, commercial, and industrial uses with Detroit on the US side and Windsor, Ontario, on the Canadian side.

The flow of the Detroit River is determined by the differential elevation of upstream Lake St. Clair and Lake Huron and downstream Lake Erie. The annual flow of the Detroit River has averaged 190,800 cfs over the more than 100 years of flow record. During the past 20 years, variations in flow between a maximum of 223,100 cfs and a minimum of 154,800 cfs have been recorded (GLBC 1976c). The approximate average current velocities of the river are 1.9 miles per hour (mph) in the Livingston and Amherstburg Channels, 1.8 mph under the Ambassador Bridge, 1.4 mph in the Fleming Channel, and 1.4 mph at Windmill Point (GLBC 1975c). The Detroit River flow into Lake Erie influences the movement of water in the western basin of the lake during all seasons.

The Detroit River enters western Lake Erie several miles north of Pointe Mouillee. The western basin of the lake is slightly less than 1,300 square miles in area and is the shallowest of the lake's three main basins, averaging

25 feet in depth. An escarpment extending from Pt. Pelee, Ontario, to Cedar Point, Ohio, serves to separate the western basin from the central basin of the lake. Because of its shallowness, thermal stratification rarely occurs in the western basin.

A profile of the Detroit River at its mouth was developed by Herdendorf (1969) based upon the Ohio Department of Natural Resources' 1963 and 1965 surveys of water characteristics in western Lake Erie. From plots of subsurface temperatures, it was determined that the river actually consists of three water masses. Water with higher temperatures was found to occupy areas along the shorelines, with a cooler midchannel. The warmer water moves southwestward along the Michigan shoreline and eastward along the Ontario shoreline, and the midchannel flow proceeds southward where it splits about 10 miles south from the river mouth. The larger volume of midchannel flow continues southward and the lesser volume moves toward Pelee Passage to the east. Strong winds and pronounced seiches (oscillations of the lake surface) can significantly disrupt this generalized pattern.

The average velocity of Detroit River water flow in western Lake Erie was found to be approximately 0.5 feet per second. Mean residence time for waters in the western basin is thus relatively short (0.17 years) because of the flushing effect of the large inflow from the Detroit River. The estimated 100-year maximum level of Lake Erie is 577.9 feet above mean sea level (US Corps of Engineers 1977).

#### 2.3.1.2. Uses

##### Upper Huron River

The Upper Huron River and its main-stem lakes provide excellent recreational potential, aquatic and adjacent terrestrial habitat for flora and fauna, and a high quality setting for residential development. According to Say and Jansson (1976), the Upper Huron River "will support a coldwater, i.e. trout fishery for a portion of the year and considerable angling occurs". Besides fishing, active recreation such as canoeing, hunting, and swimming, and passive recreation such as picnicing, bicycling, sightseeing, and nature study are enjoyed on and along this reach of the river. Excellent river-based habitat is provided by the high quality waters and extensive adjoining wetland system. The attractiveness of the natural setting has stimulated intensive residential development around the main-stem lakes.

##### Lower Huron River

Water-based recreation is popular in the lower reach of the Huron River with sailing, motorboating, fishing, and swimming in Belleville Lake being the most popular because of its accessibility. Public beaches on Belleville Lake have been closed in recent years, however, because of poor water quality conditions. Much of the shoreline of Belleville Lake is in private ownership and is developed for residential use. The City of Flat Rock utilizes the impoundment formed by the Flat Rock dam as a water supply. The sport fishery of the Lower Huron River has declined in recent years.

### Middle River Rouge

Recreational use of the upper Middle River Rouge in the project area is most intense at Phoenix Lake, Wilcox Pond, and Newburgh Lake. Both Phoenix Lake and Newburgh Lake are popular fishing lakes, and both are stocked annually with trout. Boating and swimming are also attractive at these lakes, except during algal blooms. General recreational activities are supported by the public parkland corridor along much of the river immediately north and west of Plymouth.

### Lower River Rouge

The Lower River Rouge within the Canton Township section of the project area is free-flowing, providing river-oriented types of recreation. Stream fishing, canoeing, and general recreational activities are provided in the parkland corridor along the Lower Rouge Parkway.

### Inland Lakes

The inland lakes in the project area have considerable recreational potential because of their proximity to population centers. Fishing is one of the primary recreational activities, and several of the lakes in the northern part of the project area support cold water sport fisheries. They include Oxbow Lake, Cedar Island Lake, Union Lake, and Proud Lake. Both Oxbow Lake and Union Lake are stocked with trout by the Michigan Department of Natural Resources (SEMCOG 1977). Boating and swimming are also popular activities at lakes in this area. Because of the recreational opportunity and the lakes' aesthetic setting, the shorelands largely are committed to residential development.

### Detroit River - Lake Erie

The Detroit River provides potable water for the cities of Detroit and Windsor, water-based recreational opportunity, navigation, and the large volume of clean water it conveys to western Lake Erie has a beneficial flushing effect in the lake. Trout and salmon have been introduced to the river improving fishing opportunities and Belle Isle Beach has been reopened further facilitating use of the river for recreation (MDNR 1977b). Recreational boating coexists with use of a designated channel in the river for navigation by ocean-going vessels traveling inland on the Great Lakes Waterway.

The western basin of Lake Erie serves as a water supply for both communities and industries along its shores, provides for water-based recreation, and facilitates navigation by Great Lakes shippers. The Pointe Mouillee area wetlands provide valuable waterfowl and aquatic habitat, and is also a popular hunting and fishing area.

## 2.3.1.3. Water Quality

### Huron River

The limited water quality sampling data presently available for the upper reach of the Huron River within the northern part of the project area indicate high quality waters. As the Huron River leaves the northern section of the project area west of Commerce, all state water quality standards are being met. Steady flow conditions appear to maintain relatively high quality waters. Without wet weather stream sampling data for the upper reach, however, no conclusions can be drawn regarding short-term river water quality changes which might result from storm runoff contaminant contributions. It is likely that increased solids and nutrient loadings resulting from runoff may temporarily degrade the quality of the Upper Huron River.

Water quality in the Lower Huron River is governed by upstream water quality, by non-point (area) contributions of pollutants, and by direct discharges of wastewater. Upstream from the French Landing Dam (including Belleville Lake), 70% (21 miles) of the river consists of impounded waters. These impoundments improve the assimilative capacity of the river system by increasing the time-of-passage (reducing flow velocity) which allows sediment to settle out and nutrients to become entrapped. While potentially beneficial to downstream river water quality, this effect has an adverse impact on water quality in the lakes. Deposition of undesirable oxygen-demanding solids and the algal growth stimulated by nutrient enrichment present significant problems (Environmental Control Technology Corporation 1974). Belleville Lake is the last of the series of major impoundments on the river and its waters are low in dissolved oxygen and high in nutrients.

The degree of degradation occurring in the Huron River upstream from Belleville Lake is reflected by Water Quality Indexes (WQIs) computed by the MDNR (SEMCOG 1978a):

| Reach | Minimum WQI (1976) | Maximum WQI (1976) | Mean WQI (1976) |
|---|---|---|---|
| Commerce Road Bridge | - | - | 82 |
| Upstream from Ann Arbor | 61 | 84 | 78 |
| Downstream from Ann Arbor | 57 | 82 | 75 |
| Mouth of river | 52 | 76 | 68 |

(WQI of 71 to 100 is good to excellent; 51 to 70 is medium; less than 50 is poor.)

This is the result of increased loadings of solids, nutrients, coliform bacteria, and other contaminants from both point and non-point sources. These contribute to increased turbidity, nutrient enrichment, lowering of dissolved oxygen concentrations, and bacterial conditions unsafe for body contact recreation.

Compared to the Michigan Water Quality Standards and guidelines, the available water quality data indicate that inflow to Belleville Lake is in violation of dissolved oxygen, lead, and fecal coliform standards. Ammonia and iron concentrations have exceeded levels believed toxic to fish. Total phosphorus concentrations have been higher than recommended guidelines for nutrient loading. MDNR classified Belleville Lake as eutrophic after finding excessive nutrient concentrations and low dissolved oxygen levels during a limnological survey in 1973. Conditions existing in 1977 indicate that this classification still is appropriate.

Elevated densities of fecal coliform bacteria were measured by the Wayne County Health Department during the summer of 1977 at public beaches and at other locations in Belleville Lake. The beaches were closed for the entire season.

Water quality data downstream from the French Landing Dam generally are sparse. The available data indicate that elevated levels of lead, iron, phosphorus, and fecal coliforms exist in the Lower Huron River in violation of State standards and guidelines. (For a more thorough discussion of the water quality of the Huron River see SEMCOG 1978a.)

## Middle River Rouge

The waters of the Walled Lake Branch, Johnson Drain, and the upper reach of the Middle River Rouge in the project area are enriched with nutrients. Sources contributing to this condition include non-point (area) contributions of nitrates and phosphorus from overland runoff, storm sewer discharges, and discharge from the Walled Lake WWTP. Michigan Water Quality Standards and guidelines for dissolved oxygen, phosphorus, nitrate, ammonia, and total dissolved solids were exceeded at the SEMCOG headwater sampling station on the Walled Lake Branch at Twelve Mile Road during October and November 1976 surveys (the only two surveys conducted at this site). SEMCOG (1978b) attributed these values to the discharges from the Walled Lake WWTP.

SEMCOG also sampled the Walled Lake Branch farther downstream at Beal Street in Northville. Most parameters sampled were in compliance with standards, with the exception of iron and turbidity. This was attributed to the stream's assimilative capacity. SEMCOG (1978b) concluded that the iron is the result of highly mineralized groundwater entering the stream. The loamy clay soils of the stream banks and soils carried by runoff caused the turbidity. Stream flow in this reach during steady flow conditions is about three times larger than at the upstream station resulting in some dilution of pollutant concentrations. Fecal coliform values measured during an October 1976 wet weather survey were in excess of standards. This was attributed to contamination from storm sewer discharges to the river (SEMCOG 1978b).

Flow and water quality in Johnson Drain appear to closely resemble that of the Walled Lake Branch at Northville. Iron concentrations range from 0.31 to 0.37 mg/l, which is slightly more than the 0.3 mg/l recommended limit for drinking water. Fecal coliform samples exceeded the 200/100 ml standard during the October 1976 wet weather survey.

Downstream from the confluence of Johnson Drain and the Walled Lake Branch, river water generally met standards during the SEMCOG surveys. During summer, however, water quality deteriorates in Phoenix Lake and Newburgh Lake. Results from water sampling by SEMCOG in 1976 indicate eutrophic conditions.

Sediment transported as suspended solids in the river settles out in these lakes. A reservoir sediment survey conducted by the US Army Corps of Engineers in 1969 estimated that annual sediment accumulation averages 2.91 acre-feet in Newburgh Lake and 0.53 acre-foot in Phoenix Lake (SEMCOG 1978b). Increased urbanization of adjacent areas without control of runoff and without conservation practices on agricultural lands could increase this rate, resulting in more rapid siltation. (For more information on the water quality of the River Rouge system see SEMCOG 1978b.)

## Lower River Rouge

The section of the Lower River Rouge within the project area was sampled by SEMCOG in October and November 1976. Concentrations of suspended solids, total dissolved solids, chloride, iron, fecal coliforms, and turbidity exceeded State standards.

SEMCOG attributed the elevated levels of metals and other solids to highly mineralized groundwater in the headwater area (west of the project area). The high fecal coliform bacteria levels were postulated to be the result of septic tank or animal feedlot wastes entering the stream (SEMCOG 1978b). No other water quality data exist on which to base more specific conclusions. Downstream, to the east of the project area, the increased volume of flow dilutes these pollutants to lower concentrations. Combined sewer overflows from the Lower Rouge Interceptor, coupled with flattening of the stream channel (resulting in a decreased velocity of flow), contribute to water quality problems. Dissolved oxygen levels do not meet the 5.0 mg/l standard and high fecal coliform levels present a health hazard at times (SEMCOG 1978b).

## Inland Lakes

Information on the quality of inland lake waters in the project area is limited. Data which have been collected by MDNR and SEMCOG indicate that the chemical quality and biological productivity of the lakes varies from "extremely good quality--low productivity" to "poor quality--high productivity".

White Lake and Wolverine Lake have been classified as mesotrophic (MDNR 1977c). Commerce Lake, Oxbow Lake, Union Lake, and Walled Lake have been classified as eutrophic (SEMCOG 1977a).

Nutrient sources which contribute to the enrichment of some of the lakes in the project area include overland runoff, storm sewer discharge and septic tank effluent. No detailed surveys have been conducted to determine the relative contribution of nutrients entering the lakes from each of these sources.

Detroit River - Lake Erie

Phosphorus loadings to Lake Erie are of especial concern because it is recognized to be the critical nutrient in the eutrophication of Lake Erie (US Corps of Engineers 1975). Loadings of total phosphorus from the Detroit River to Lake Erie have decreased by 64% over the 1966 to 1977 period. Table 2 shows the estimated relative loadings of total phosphorus to the western basin from the various tributary sources which are responsible for the lake concentrations. The Detroit River is estimated to contribute 77% of the total phosphorus loadings to the western basin while the Huron River contributes only 2%.

Table 2. Total phosphorus loads from tributaries to the western basin of Lake Erie (US Corps of Engineers 1975).

| | | Phosphorus Load | |
|---|---|---|---|
| | | Tons/Year | % of Total |
| US - Canada | Detroit River | 10,633 | 77 |
| US | Huron River | 277 | 2 |
| | Raisin River | 257 | 2 |
| | Maumee River | 2,462 | 18 |
| | Portage River | 123 | 1 |
| Canada | Sturgeon Creek | 1 | - |
| | Western Basin Total | 13,753 | 100 |

## 2.3.2. Groundwater

### 2.3.2.1. Occurrence

Glacial deposits are the most important source of groundwater in the project area. Bedrock formations also yield groundwater; however, the relatively low permeability of shale bedrock and the mineralized composition of the groundwater in bedrock strata limit the use of this water for many purposes.

The well-sorted alluvial deposits of the floodplains and terraces along the Huron River and Middle and Lower Rivers Rouge in the project region are up to 75 feet thick and yield groundwater under water table conditions (Mozola 1969). Water levels in these deposits often are close to the land surface and are affected to a large extent by the volume of flow in the rivers.

Sand and gravel outwash deposits in the project region are the most important source of groundwater. High infiltration rates in some areas assure recharge of aquifers. Groundwater in surficial sands is generally under watertable conditions and watertable levels fluctuate readily with wet and dry weather conditions. Water in these deposits is especially susceptible to contamination from surface sources. Artesian or semi-artesian conditions also are likely to exist in sand and gravel deposits interbedded with clays which act as confining beds.

Moraines and till plains are less significant as aquifers, unless interbedded with outwash and alluvium (Twenter 1975). Unlike conditions in outwash and alluvium, groundwater in morainal areas is generally under artesian conditions. Due to the impermeable character of the confining tills, morainal groundwater is much less susceptible to contamination from the surface than is groundwater in an unconfined condition.

The predominantly clay sediments of the glacial lake plain areas usually are poor sources of groundwater. In some areas, however, the sediments contain interbedded sand deposits which, although usually thin, may serve as significant groundwater sources for domestic water supply (Twenter 1975).

Water in bedrock in the project region exists under artesian conditions in sandstones, shales, limestones, and dolomites.

#### 2.3.2.2. Groundwater Quality

The quality of groundwaters in the project region is dependent on subsurface conditions and contamination from surface sources. Total hardness usually exceeds 200 mg/l in the floodplain alluvial and outwash deposits. Water quality in deeper glacial deposits is degraded in some locations by mineralized water from underlying bedrock formations. Water quality of bedrock aquifers is generally good when withdrawn from shallow depths; however, mineralization increases with depth.

#### 2.3.2.3. Uses

The majority of residents in the project area depend on the Detroit Water System for domestic, commercial, and industrial water supplies. A significant number of wells, however, penetrate glacial drift and bedrock aquifers. In the northern part of the project area, the communities of Commerce, Wolverine Lake, and Walled Lake each utilize wells for potable water. Union Lake, White Lake, and the residents of the more rural parts of the area not served by these systems rely on individual wells for supply. In the Wayne County section of the project area, Belleville utilizes some groundwater to supplement the water it purchases from Detroit. Residents of Sumpter and Huron Townships rely to a great extent on individual wells for domestic supply. Other developed parts of Wayne County purchase water from the Detroit System, except for Flat Rock and Rockwood, which utilize water from the Huron River.

### 2.3.3. Aquatic Biota

#### 2.3.3.1. Upper and Lower Huron River

Based on limited sampling of the Upper Huron River by WAPORA, species of plankton seem to be similar to those generally found in lake habitats. The Upper Huron, with a diversity of habitats and good water quality (Section 2.3.1.3.), is reported to support an ephemeropteran (mayfly) - trichopteran (caddisfly) assemblage of species (Enviro Control, Inc. 1976).

The Upper Huron River supports typical "lake" fishes, including four game species and 11 pan species. The sunfish and bass fishery of this segment of the Huron is the most important in the project area. Thirty-six non-game forage species occur in the area, including the cisco, which is considered a "threatened" species in the State of Michigan.

Diatoms, green algae, and blue-green algae are the three major groups of plankton in the Huron River. Green algae, especially *Chlamydomonas,* have their greatest number of blooms in the lower segments of the river (Borchardt 1958).

Benthic communities of the Lower Huron have been described as an oligochaete (worm) - chironomid (midge) assemblage (Enviro Control, Inc. 1976). Areas of deoxygenated water and substrates with heavy, organically-rich silt loads tend to increase the number of tubificid habitats.

The Lower Huron River supports 11 game species and 11 pan species of fish. Several hybrids introduced for recreation purposes also are present. Thirty-eight non-game species have been recorded from the area. No threatened or endangered species are known to occur in this section of the river.

### 2.3.3.2. Middle and Lower Rivers Rouge

Phytoplankton communities of the sections of the Middle and Lower Rivers Rouge in the project area generally are dominated by diatoms, especially *Navicula.* This community was described as indicative of moderate water quality (MWRC 1975).

Benthic populations are considered indicative of moderately enriched waters (MWRC 1975). The Middle Rouge segment had communities composed of leeches, snails, crayfish, damselfly naiads, true bugs, beetles, and midges. The community was reduced to only the most pollution-tolerant species for some distance immediately north of the 10-Mile Road in Novi. This was attributed to the wastewater discharge from the Michigan Tractor Sales facility (MWRC 1975). Water quality recovered downstream and the number of species increased. The Lower Rouge benthos in the project area were dominated by chironomids, again characteristic of enriched waters.

The Middle and Lower Rivers Rouge section of the project area encompasses small streams which support fish communities in undegraded remnants of the drainage. Sport fisheries are of minor importance, although a few game and pan species do occur. The redside dace, a species designated as "threatened" by the State of Michigan, has been noted in the Johnson Drain area, south of Northville (MWRC 1975). Thirty-four species have been recorded from the area and 13 additional species have been reported in nearby drainages. It appears, however, that the number of species in the area is decreasing. Only 23 species were recorded in recent surveys (MWRC 1975).

### 2.3.3.3. Detroit River - Lake Erie

Plankton in the western basin of Lake Erie appear to be increasing in total numbers. Diatoms seem to be decreasing and blue-green and green algal populations are increasing. Species of blue-green algae associated with organic pollutants are becoming more common (GLBC 1975d).

The western basin area at the mouth of the Detroit River exhibits a very high density of pollution-tolerant organisms such as tubificid worms and chironomids. Some of the highest densities of benthic organisms in the entire lake have been reported in this area (Veal and Osmond 1968).

The species of fish most commonly found in the western basin of Lake Erie include the white bass, walleye, yellow perch, carp, buffalo, catfish, and suckers (Corps of Engineers 1974). These species are regularly caught by sport and commercial fishermen. Twenty-two species were found by trawling in 1970 near Monroe, Michigan. Yellow perch, carp, goldfish, gizzard shad, alewives, emerald shiners, spottail shiners, white bass, and sheepshead (freshwater drum) comprised 97.5 percent of the total numbers of fish caught (Parkhurst 1972). Though the productivity of Lake Erie has not declined, Applegate and Van Meter (1970) point out that fish production has shifted to medium and low-value species such as yellow perch, white bass, smelt, carp, and sheepshead.

### 2.3.3.4. Threatened and Endangered Species

Five species which potentially may occur in the project area are designated by the State of Michigan as "threatened". These include the northern madtom, silver shiner, redside dace, eastern sand darter, and cisco. With the exceptions of the cisco (or lake herring) and the redside dace, these species are reported from the western section of the Huron River, outside the project area. No species of fish designated as "endangered" is known to occur in the project area.

# 3.0. MAN-MADE ENVIRONMENT

## 3.1. Demography and Economics

### 3.1.1. Demographic Trends

The Huron Valley Wastewater Control System project area is an integral part of the Detroit Standard Metropolitan Statistical Area (SMSA). The project area is strongly influenced by the population trends of the City of Detroit and the other segments of the Detroit SMSA.

Detroit population began to decline after 1950, and the suburbs to the west and north received most of the higher income emigrants. Eventually, many of these communities lost population to suburbs still farther north and west. The continuing Detroit out-migration favored these more distant areas. Some of the project area communities fall into this group. Between 1960 and 1970 the US Bureau of the Census reported a net loss of 158,662 for Detroit. The 1960 to 1970 growth rate was -9.5%. Detroit's rate of population loss accelerated to -11.7% during the 1970 to 1975 period, with a net loss of 156,397. Wayne County's overall low growth rate between 1960 and 1970 and its loss of population since 1970 may be explained by the Detroit losses.

Communities on the periphery of Detroit have exhibited varying abilities to attract the migrating population, which is still strongly tied to the Detroit area because of its industry. Jobs, income, and financial strength have shifted to project area communities according to the ability of the various communities to compete for metropolitan population. The exodus of "basic" industry from the inner city to less densely populated areas at the periphery has been another influence on population trends in the project area. In the outlying communities, it is more economical for industry to acquire the large tracks of land needed for structures adapted to modern manufacturing. Development of highways has made producers less dependent on rail and water transportation. Tax advantages, primarily in the form of lower property taxes and lower land costs also have been an important incentive for industrial out-migration.

Project area population growth rates are higher than US, State of Michigan, and Detroit SMSA rates. The trends from 1960 to 1970 and 1970 to 1975 are shown in Table 3.

Oakland County

Oakland County's rate of growth was relatively high between 1960 and 1970 (31.5%). This was much higher than the rate for the Detroit SMSA over the same period. Population growth in Oakland County from 1970 to 1975 (6.3%) was not as rapid as it had been during the 1960s.

The section of the project area in Oakland County grew at a slightly lower rate (30.5%) than the County as a whole between 1960 and 1970. While Oakland County overall has sustained a lower growth rate between 1970 and 1975, the project area section of the County has grown at a rate of 37.1%. Recent population trends may be due to the location of the project area near

Table 3. Population trends in the Huron Valley Wastewater Control System project area (US Bureau of the Census 1961 and 1977a).

| | 1960 | 1970 | 1973[2] | 1975[2] | % Change 1960 to 1970 | % Change 1970 to 1975 |
|---|---|---|---|---|---|---|
| United States | 179,323,175 | 203,184,722 | 209,844,000 | 213,137,000 | 13.3 | 4.9 |
| Federal Region V[1] | 39,638,888 | 44,057,447 | 44,727,291 | 44,861,017 | 11.1 | 1.8 |
| Michigan | 7,823,194 | 8,875,083 | 9,061,000 | 9,157,000 | 13.4 | 3.2 |
| Detroit SMSA | 3,762,260 | 4,435,051 | 4,446,800 | 4,444,700 | 17.9 | 0.2 |
| Detroit | 1,670,144 | 1,511,482 | 1,409,973 | 1,335,085 | -9.5 | -11.7 |
| Oakland County | 690,259 | 907,871 | 941,709 | 965,200 | 31.5 | 6.3 |
| Wayne County | 2,666,297 | 2,670,368 | 2,596,000 | 2,518,800 | 0.15 | -5.7 |
| Huron Valley Project Area | 133,320 | 182,054 | 204,233 | 231,305 | 36.5 | 27.0 |
| White Lake Twp. | 8,381 | 14,311 | 17,538 | 19,008 | 70.7 | 32.8 |
| Walled Lake | 3,550 | 3,759 | 4,157 | 4,282 | 5.8 | 13.9 |
| Wolverine Lake | 2,404 | 4,301 | 4,839 | 5,376 | 78.9 | 25.0 |
| Commerce Twp. | 9,608 | 14,556 | 16,197 | 17,317 | 51.5 | 19.0 |
| Novi (incl. Novi Twp.) | 6,454 | 9,850 | 13,429 | 17,050 | 52.6 | 73.1 |
| Northville (part) | 985 | 2,367 | 2,862 | 3,446 | 140.3 | 45.6 |
| Northville (part) | 2,988 | 3,003 | 2,939 | 2,896 | 0.5 | -3.5 |
| Northville Twp. | 7,673 | 9,522 | 11,349 | 12,033 | 24.1 | 26.4 |
| Plymouth | 8,766 | 11,758 | 11,537 | 11,930 | 34.1 | 1.4 |
| Plymouth Twp. | 8,364 | 17,497 | 18,394 | 19,898 | 109.2 | 13.7 |
| Belleville | 1,921 | 2,406 | 2,792 | 2,904 | 25.2 | 20.7 |
| Canton Twp. | 5,313 | 11,026 | 13,457 | 15,243 | 107.5 | 38.2 |
| Van Buren Twp. | 9,509 | 13,162 | 16,743 | 17,916 | 38.4 | 36.1 |
| Flat Rock | 4,696 | 5,643 | 5,888 | 6,544 | 20.2 | 16.0 |
| Sumpter Twp. | 5,972 | 8,091 | 10,120 | 10,934 | 35.5 | 35.1 |
| Huron Twp. | 6,884 | 8,030 | 8,769 | 9,045 | 16.6 | 12.6 |
| Woodhaven | - | 3,566 | 8,165 | 10,698 | - | 200.0 |
| Trenton | 18,439 | 24,127 | 27,572 | 28,432 | 30.8 | 17.8 |
| Gibraltar | 2,196 | 3,842 | 4,223 | 4,170 | 75.0 | 8.5 |
| Rockwood | 2,026 | 3,275 | 3,453 | 3,487 | 59.2 | 8.1 |
| Oakland County part of Project Area | 31,382 | 49,144 | 59,022 | 66,479 | 56.6 | 35.3 |
| Wayne County part of Project Area | 101,938 | 132,910 | 145,211 | 164,826 | 30.4 | 23.2 |

[1] Federal Region V includes Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.
[2] Official estimates by the US Bureau of the Census.

the western edge of the county. This region now is undergoing rapid suburban development. The segments of Oakland County which are outside the project area and which are closer to Detroit underwent their most rapid suburban development during the 1950s and 1960s.

Within Oakland County, the City of Novi has been experiencing one of the fastest rates of population growth in the project area, 11.1% per year from 1970 to 1975 (Table 3). Walled Lake and Wolverine Lake Village also have experienced high rates of population growth.

### Wayne County

Wayne County's population grew very little between 1960 and 1970. The population of Wayne County increased by only 4,071 persons during the period. This amounted to a growth rate of 0.15%. Between 1970 and 1975, Wayne County's growth rate was -5.7%, a net loss of 151,568 persons. Population in the Huron Valley project area section of Wayne County increased at a rate of 30.4% between 1960 and 1970. While Wayne County lost population overall during the 1970 to 1975 period, the project area segment of the County grew by 23.2%.

Population growth rates in Northville and Plymouth in Wayne County have been stable or declining slightly. Recent completion of Interstate Highways 96 and 275 probably will have a substantial impact on these and the other western suburbs. Belleville experienced a high population growth rate during the 1970s (Table 3).

In the southeastern section of the project area, Flat Rock's rate of population growth increased substantially from 4,696 in 1970 to 6,544 in 1975 (39%). Rockwood is the second smallest city (1975 population of 3,847) in the project area and has experienced the lowest rate of population growth among the cities.

Woodhaven and Gibraltar, neighboring cities south of Detroit, both had populations of about 3,500 in 1970. By 1975, Woodhaven had grown to 10,700, over twice the size of Gibraltar. Neither Flat Rock nor Trenton, located near Woodhaven, have experienced growth similar to Woodhaven's.

### 3.1.2. Population Projections

The primary forces affecting population levels in the project area are the out-migration of population and industry from the City of Detroit and its older suburbs. The historical trends in demographics were considered to establish the validity of population projections presented by the Wayne County Department of Public Works. Also, the projections and sewer service area maps established by SEMCOG were examined. There was no consistent pattern within either of the projections and both projections exceeded the State of Michigan Department of Management and Budget projections. Generally Wayne County projections did not follow historical trends in the Oakland County communities of Novi and Walled Lake. It is difficult to determine the reasonableness of these projections without a great deal of additional information about local policies and projects (non-sewer related). All projections recognize a continuation of the present high population growth within the next five year period. At that time saturation may be reached due to transportation and environmental constraints.

The Wayne County projections for Northville Township and Northville project a higher growth rate than recent trends show. The growth rate in Northville Township during 1970-1975 was 26.4% and the growth rate in Northville (Wayne County) was 4.5%. Wayne County has projected growth for the planning period to be 224% for Northville Township and 213% for Northville. There are no consistent projections for Canton Township. This area may experience limited growth due to its location (near the Detroit Metropolitan Airport and along I-275). Nodal growth can be expected at interchanges between 1-275, US-12, and M-153. Wayne County projects a continuation of recent trends for Plymouth Township and this appears to be consistent with normal population growth.

Due to many factors, the southern portion of the projected service area may not show growth rates that are consistent with recent trends. Local planning efforts and circumstances will dictate later growth. Several communities may be reaching saturation (Woodhaven, Trenton, etc.) or may not have land suitable for development (Southern Browntown). Factors such as preservation of rural character are prevalent opinions in Brownstown, Pointe Mouillee and Huron Township. In the area from Canton Township south to Brownstown Township it appears that the overall projection by SEMCOG should be realized with some alternative distribution of population. Due to the discrepancies found in both population projections, the USEPA choose to use the unadopted projections of SEMCOG (Table 4) which showed a moderate growth overall for the project area and appeared to be more consistent with recent trends in the southern portion of the project area.

Total project area population would increase from its 1975 estimated population of 231,305 (Table 3) to a 1995 population of 407,605 -- an increase of 76.2%. This represents an average annual growth rate of 3.8%.

The projection of future population in the Facility Plan estimated a 1995 project area population of 421,808 (Hubbell, Roth & Clark, Inc. 1976). No projections for the project area are available from other sources. New projections disaggregated to the county level recently have become available from the Bureau of Economic Analysis (US Department of Commerce) and the State of Michigan (Department of Management and Budget). These projections are lower than both Wayne County and SEMCOG projections.

### 3.1.3. Income

Per capita money income in the State of Michigan grew by 41.5% from 1969 to 1974. In Oakland and Wayne Counties the corresponding figures are 41.2%

Table 4. Population projections for the Huron Valley Wastewater Control System project area. (Based on SEMCOG Small Area Forecast Alternative 6, 1977.)

| | 1980 | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| OAKLAND COUNTY | | | | |
| Commerce Twp. | 16,415 | 19,613 | 22,253 | 24,402 |
| Northville (pt) | 2,859 | 2,490 | 3,072 | 2,883 |
| Novi | 30,571 | 29,284 | 29,150 | 29,218 |
| Walled Lake | 3,683 | 3,755 | 3,529 | 3,406 |
| White Lake Twp. | 25,395 | 26,496 | 29,232 | 32,197 |
| Wolverine Lake | 5,013 | 4,527 | 3,964 | 3,874 |
| | 83,963 | 86,165 | 91,200 | 95,980 |
| WAYNE COUNTY | | | | |
| Belleville | 4,802 | 4,741 | 4,562 | 4,404 |
| Brownstown Twp. | 39,981 | 54,212 | 50,287 | 52,908 |
| Canton Twp. | 51,028 | 60,147 | 57,757 | 59,785 |
| Flat Rock | 9,763 | 12,030 | 11,915 | 11,683 |
| Gibraltar | 4,147 | 3,283 | 4,246 | 4,029 |
| Huron Twp. | 10,098 | 12,837 | 14,160 | 19,766 |
| Northville Twp. | 17,387 | 21,093 | 22,900 | 22,390 |
| Northville (pt) | 3,048 | 2,775 | 2,766 | 2,995 |
| Plymouth | 12,000 | 11,452 | 11,518 | 11,848 |
| Plymouth Twp. | 18,727 | 20,012 | 20,561 | 23,002 |
| Rockwood | 3,381 | 2,905 | 3,399 | 3,588 |
| Sumpter Twp. | 10,414 | 10,855 | 13,540 | 18,899 |
| Trenton | 23,612 | 20,867 | 22,260 | 21,368 |
| Van Buren Twp. | 29,480 | 32,717 | 39,413 | 45,537 |
| Woodhaven | 10,819 | 9,460 | 9,972 | 9,423 |
| | 239,687 | 279,386 | 289,256 | 311,625 |
| TOTAL | 323,650 | 365,551 | 380,456 | 407,605 |

and 42.5%. Per capita income, median family income, and trade data are presented in Table 5. Overall, per capita money income grew by 45.3% from 1969 to 1974 in the eleven project area cities. This rate was greater than rates in the State of Michigan (41.5%), Oakland County (41.2%), and Wayne County (42.5%) over the same period. Detroit per capita income grew by 39.5%. Five of the eleven project area cities grew at rates substantially larger than either county. Similar data are not available for project area townships.

Per capita income increased by 51.5% between 1969 and 1974 in the City of Novi. Income growth in the communities of Walled Lake and Wolverine Lake Village was lower than the average for the project area. Walled Lake, however, has the highest per capita retail activity of any city, including Detroit.

Per capita income is decreasing in the City of Plymouth, although it appears to be one of the most economically sound communities in the region. Belleville's income growth has been lower than average. Flat Rock showed substantial growth in economic strength during the early 1970s. While the 48% growth of per capita income from 1969 to 1974 was among the highest of cities in the project area, the growth of median family income at Flat Rock and the 1970 median family income level were next to lowest among the eleven cities in the project area. Housing values are relatively low in comparison with the other communities.

Rockwood, in terms of per capita income, has experienced a high rate of growth during the 1970s. Median income is next to lowest among the eleven project area cities while mean family income exceeded the median by the largest dollar margin of any of the cities. A substantial disparity in the distribution of income may be the cause. The median value of owner occupied houses is less than the average. Median contract rent is lowest in the project area. Woodhaven's housing values (median contract rent and median value of owner occupied dwellings) are the highest in the project area. Its retail sales experience is second highest.

### 3.1.4. Employment

Employment trends, especially of the "basic" industries, are a major determinant of how an area's population has changed over time. "Basic" industries produce goods and services that will be exported to other areas. Basic industries are considered to include manufacturing, agriculture, and mining. "Local" industries serve the local population. All other employment is considered local.

Basic, local, and total employment for Oakland County, Wayne County, and the Detroit SMSA are presented in Table 6. Employment statistics for Michigan and Federal Region V are included for comparison.

Employment in the Detroit SMSA, Oakland County, and Wayne County is concentrated in the manufacturing sector. The SMSA's level of local employment is rising, but at a slower rate than the remainder of the US or Federal Region V. The Detroit SMSA's growth in manufacturing employment has been consistent with national manufacturing employment growth trends. Automobile manufacturing employment has been increasing in the Detroit SMSA, but it has been at a rate

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Table 5. Income, owner-occupied units, population, wholesale trade, and retail trade for the eleven cities in the Huron Valley project area, Detroit, and Wayne and Oakland Counties, Michigan (US Bureau of the Census 1961 and 1971; Verway and Grier 1977).

| CITIES | Belleville | Flat Rock | Gibraltar | Northville | Plymouth | Rockwood | Trenton | Woodhaven | Walled Lake | Novi | Wolverine Lake Vil. | Detroit | COUNTIES<br>Oakland | Wayne |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Family Income 1970 | NA | 13,323 | 13,051 | 15,666 | 14,490 | 14,110 | 15,351 | 13,650 | 12,717 | 14,567 | 13,019 | 11,015 | 16,521 | 12,443 |
| Median Family Income | | | | | | | | | | | | | | |
| 1970 $\bar{X}$=13,124; S=982 | NA | 12,902 | 12,651 | 14,837 | 13,082 | 12,403 | 14,581 | 13,387 | 11,625 | 13,342 | 12,439 | 10,045 | 13,826 | 11,351 |
| 1960 | NA | 7,529 | NA | 7,642 | 7,755 | NA | 8,047 | NA | 5,060 | 6,934 | NA | 6,825 | 7,576 | 6,597 |
| % Change 1960-1970 $\bar{X}$=83.2; S=11.2 | NA | 71.4 | NA | 94.2 | 68.2 | NA | 81.2 | NA | 91.2 | 92.4 | NA | 47.2 | 82.5 | 72.1 |
| Per Capita Money Income of Persons | | | | | | | | | | | | | | |
| 1974 | 5,874 | 5,442 | 5,317 | 6,242 | 5,862 | 5,111 | 5,724 | 5,180 | 4,825 | 5,811 | 5,180 | 4,463 | 6,350 | 4,966 |
| 1969 | 4,125 | 3,676 | 3,548 | 4,236 | 4,154 | 3,432 | 3,978 | 3,662 | 3,380 | 3,835 | 3,662 | 3,199 | 4,496 | 3,485 |
| % Change 1969-1974 $\bar{X}$=45.3; S=3.8 | 42.4 | 48.0 | 49.8 | 47.4 | 41.1 | 48.9 | 43.9 | 41.4 | 42.8 | 51.5 | 41.4 | 39.5 | 41.2 | 42.5 |
| Rank 1974 | 43 | 63 | 69 | 32 | 44 | 86 | 25 | 80 | 112 | 45 | 524 | 183 | NA | NA |
| Poverty, % of All Families, 1970 | NA | 5.1 | 2.0 | 2.0 | 1.2 | 2.5 | 3.0 | 4.3 | 2.3 | 4.9 | 2.4 | 11.3 | [illegible] | 8.1 |
| Median Value Owner-Occupied Units | | | | | | | | | | | | | | |
| 1970 $\bar{X}$=23,936; S=3,004 | 19,200 | 20,400 | 21,400 | 25,900 | 23,800 | 21,900 | 26,000 | 26,900 | 18,300 | 26,100 | 22,400 | 15,600 | NA | NA |
| Median Value Contract Rent, 1970 | 136 | 107 | 128 | 114 | 129 | 93 | 119 | 166 | 133 | 110 | 127 | [illegible] | NA | NA |

Table 6. Comparison of employment trends in Federal Region V, Michigan, the Detroit SMSA, Oakland County, and Wayne County (US Bureau of the Census 1961 and 1971; US Bureau of the Census 1977b; US Department of Labor 1977a).

| | FEDERAL REGION V | | | MICHIGAN | | |
|---|---|---|---|---|---|---|
| | 1960 | 1970 | Change 1960-1970 | 1960 | 1970 | Change 1960-1970 |
| Basic Employment | 5,666,776 | 5,983,579 | 5.6% | 1,076,602 | 1,144,707 | 6.3% |
| • Agriculture, Forestry and Fisheries | (856,374) | (551,214) | (-35.6%) | (93,662) | (58,707) | (-37.3%) |
| • Mining | (85,502) | (80,865) | (-5.4%) | (15,340) | (14,500) | (-5.5%) |
| • Manufacturing | (4,724,900) | (5,351,500) | (13.3%) | (967,600) | (1,071,500) | (10.7%) |
| Local Employment | 8,883,720 | 10,937,213 | 23.1% | 1,650,262 | 2,108,123 | 27.7% |
| Total Employment | 14,550,496 | 16,920,792 | 16.3% | 2,726,864 | 3,252,830 | 19.3% |
| Multiplier | 2.57 | 2.83 | | 2.53 | 2.84 | |
| Population | 39,638,888 | 44,057,447 | | 7,823,194 | 8,875,083 | |
| Percent Employed | 36.7% | 38.4% | | 34.8% | 36.6% | |

| | DETROIT SMSA | | | |
|---|---|---|---|---|
| | 1960 | 1970 | 1975 | Change 1960-1970 |
| Basic Employment | 529,291 | 501,139 | 508,666 | 9.7% |
| • Agriculture, Forestry and Fisheries | (12,891) | (10,739) | (2,066) | (-16.7%) |
| • Mining | (1,000) | (1,100) | (1,100) | (10%) |
| • Manufacturing | (515,400) | (569,300) | (505,500) | (10.5%) |
| Local Employment | 670,209 | 969,861 | 1,058,634 | 44.7% |
| Total Employment | 1,199,500 | 1,551,000 | 1,567,300 | 29% |
| Multiplier | 2.27 | 2.67 | 3.08 | |
| Population | 3,762,260 | 4,435,051 | 4,444,700 | |
| Percent Employed | 31.9% | 35% | 35.2% | |

Table 6. Comparison of employment trends (concluded).

| | OAKLAND COUNTY | | | |
|---|---|---|---|---|
| | 1960 | 1970 | 1975 | Change 1960-1970 |
| Basic Employment | 101,940 | 120,029 | 86,380 | 17.4% |
| ● Agriculture, Forestry and Fisheries | (2,314) | (2,220) | (637) | (-4.1%) |
| ● Mining | (321) | (439) | (252) | (36.8%) |
| ● Manufacturing | (99,305) | (117,370) | (85,491) | (18.2%) |
| Local Employment | 138,921 | 224,291 | 214,857 | 61.4% |
| Total Employment | 240,861 | 334,320 | 301,237 | 38.8% |
| Multiplier | 2.36 | 2.87 | 3.49 | |
| Population | 690,259 | 907,871 | 965,200 | |
| Percent Employed | 34.9% | 37.9% | 31.2% | |

| | WAYNE COUNTY | | | |
|---|---|---|---|---|
| | 1960 | 1970 | 1975 | Change 1960-1970 |
| Basic Employment | 383,076 | 378,654 | 301,194 | -1.5% |
| ● Agriculture, Forestry and Fisheries | (2,791) | (3,580) | (943) | (28.3%) |
| ● Mining | (548) | (1,197) | (910) | (118%) |
| ● Manufacturing | (379,737) | (373,877) | (299,341) | (-1.5%) |
| Local Employment | 570,833 | 619,550 | 499,701 | 8.5% |
| Total Employment | 953,959 | 998,204 | 800,895 | 4.6% |
| Multiplier | 2.49 | 2.64 | 2.66 | |
| Population | 2,666,297 | 2,670,360 | 2,518,800 | |
| Percent Employed | 35.8% | 37.4% | 31.8% | |

less than US automobile manufacturing employment growth. This concentration in automobile manufacturing has made the Detroit SMSA vulnerable to periods of high unemployment. This was the case during 1975 when economic recession and the "Energy Crisis" resulted in a lower demand for automobiles.

During the 1960 to 1970 period, Oakland County employment grew at a higher rate than the Detroit SMSA in the basic, local, and total employment sectors. This indicates a higher level of employment diversity than found in the SMSA as a whole. Employment is concentrated in manufacturing, but less so than in the SMSA. The higher multiplier value indicates that in comparison with the Detroit SMSA, a greater percentage of Oakland County employment was in the local sector in 1960 and 1970.

In Oakland County both durable and non-durable manufacturing grew during the 1960 to 1970 period. Durables manufacturing employment grew 24.5% while non-durables grew by only 3.1%. Machinery manufacturing grew by 26.6% while primary metals industries lost employment at a rate of 0.5% for the period. Transportation equipment manufacturing grew by 9.8%. Textiles and apparel employment had the highest growth rate (61.6%) of non-durables manufacturing between 1960 and 1970. The lowest employment growth rate (-43.9%) in the non-durables sector occurred in the food and kindred industries.

Unlike Oakland County, the rate of employment growth in Wayne County was lower than the remainder of Michigan and the SMSA rate for the 1960 to 1970 period. Basic employment declined 1.5%, a net loss of 4,422 jobs. Because very little of Wayne County's employment is in mining or agriculture, this loss can be attributed to a decline in manufacturing employment. The local employment sector grew in Wayne County during the period, but only at a rate of 8.5%, compared to the overall SMSA rate of 44.7%. Total employment grew by 4.6% from 1960 to 1970, while Wayne County was higher than either Oakland County or the Detroit SMSA. In 1970, however, it was less than for either of those areas. This indicates that manufacturing employment was of relatively greater importance in Wayne County in 1970. This also is indicated by the slow rate of local employment growth.

Wayne County lost manufacturing employment from 1960 to 1970 in both the durables (-8.8%) and the non-durables (-21.7%) sectors. The greatest loss (-14.1%) in the durables sector occurred in the primary metals industries. Transportation equipment manufacturing employment rose by less than 100 jobs, equivalent to a growth rate of 0.05%. Textiles and apparel employment grew by 11.9% while food and kindred employment had a growth rate of -47.5% over the 1960 to 1970 period.

From 1970 to 1976, the Oakland County unemployment level was less than the SMSA but greater than the national level for each year throughout the period. The lowest level (5.5%) occurred in 1973 while the highest level of unemployment (12.3%) occurred in 1975. Except for 1971, Oakland County's unemployment rate was equal to or less than the Michigan level. The Wayne County unemployment level was greater than each of the others in each of the years from 1970 through 1976. The lowest level (6.9%) occurred in 1973 while the highest level (13.9%) occurred in 1975.

Potential new industrial development in or near the project area includes General Motors' tentative plans to build a new plant at Romulus and the possible expansion of a plant at Livonia (Michigan Department of Commerce 1975). Employment statistics in 1976 indicate a recovery from the high unemployment of 1975, although manufacturing employment is less than 1974 levels (US Department of Labor 1977b).

### 3.1.5. Public Finance

The financial condition of the communities in the Huron Valley Wastewater Control System project area basically is a reflection of the economic condition of the metropolitan area in which they are situated. The Detroit metropolitan area has experienced significant demographic and economic changes during the past fifteen years.

The nature of the economic opportunities being gained by communities on the periphery of the metropolitan area as previously discussed are reflected by the decline of a broad spectrum of services in Detroit. These services will be expected to show corresponding increases in nearby areas. To a substantial extent capital improvements will be necessary, and will have to rest on sound economic and financial bases.

One of the standards used to evaluate the financial condition of a local government is "net direct and over-lapping tax-supported debt per capita" (Moak and Hillhouse 1975). The ratio is designed to measure the total portion of general obligation debt which is not self-sustaining. These ratios "supply a relative figure for comparison with other governments, but do not show the true capacity to support debt... In a residential suburb of upper-middle income, or quite wealthy inhabitants, this debt ratio may safely be in the $1,000-$5,000 per capita range, whereas in a suburb where only low-income workers lived, $500 or less per capita might be a safe upper limit." In Tables 7 and 8 "Net Debt Per Capita, Full Faith and Credit Pledge" most closely approximates this ratio. It tends to overestimate the value of the ratio, because not all debt with revenue support has been separated out. Furthermore sinking funds or other funds maintained for the purpose of long-term debt retirement should be included to offset community indebtedness. The cities of Novi, Trenton, and Northville which exhibit relative economic strength are well within the range of financial safety for reasonably prosperous communities (Table 7). The debt ratios of Novi and Northville are only somewhat greater than the average for the entire group, and are only slightly higher than $1,000. Trenton's ratio, $745, is actually less than the average for the group.

The tax rates of Novi, Trenton, and Northville are 58.51, 57.86, and 60.78, respectively, They are somewhat greater than the project area average of 55.19. Two communities have total tax rates greater than 67. The corresponding figure for Detroit is 71.83.

Table 7. Debt, taxes, and SEV for ten cities in the Huron Valley project area, Michigan (US Bureau of the Census 1961 and 1971; Verway and Grier 1977).

| | Belleville | Flat Rock | Gibraltar | Northville | Plymouth | Rockwood | Trenton | Woodhaven | Walled Lake | Novi |
|---|---|---|---|---|---|---|---|---|---|---|
| **Population** | | | | | | | | | | |
| 1977 Extrapolated from Regular Census | 3,130 | 6,925 | 4,308 | 6,763 | 11,999 | 3,579 | 30,361 | 16,601 | 4,511 | 21,046 |
| **State Equalized Valuation** | | | | | | | | | | |
| 1977 (in $) | 16,362,010 | 119,968,870 | 46,628,270 | 49,581,070 | 88,621,840 | 21,248,750 | 373,065,910 | 126,470,900 | 29,317,425 | 183,676,250 |
| **SEV Per Capita** | | | | | | | | | | |
| 1977 (in $) | 5,227 | 17,324 | 10,823 | 7,331 | 7,385 | 5,907 | 12,287 | 7,618 | 6,499 | 8,727 |
| **Taxes 1976 (in $)** | | | | | | | | | | |
| County | 124,760 | 886,259 | 346,301 | 318,305 | 636,423 | 151,177 | 2,699,890 | 913,946 | 152,694 | 815,097 |
| City | 263,694 | 1,580,517 | 823,439 | 507,746 | 1,382,983 | 319,529 | 4,886,196 | 1,509,162 | 620,753 | 1,543,118 |
| School | 536,453 | 3,672,984 | 1,501,861 | 2,031,453 | 3,629,382 | 655,635 | 13,049,775 | 4,840,445 | 1,087,427 | 6,297,848 |
| Total | 924,908 | 6,139,761 | 2,671,603 | 2,857,504 | 5,648,789 | 1,126,342 | 20,635,862 | 7,263,554 | 1,860,875 | 8,656,063 |
| **Tax Rates 1976 (¢ per $1000)** | | | | | | | | | | |
| County | 7.57 | 7.57 | 7.57 | 6.77 | 7.57 | 7.57 | 7.57 | 7.57 | 5.51 | 5.51 |
| Township or City | 16.00 | 13.50 | 18.00 | 10.80 | 16.45 | 16.00 | 13.70 | 12.50 | 22.40 | 10.43 |
| School | 32.55 | 31.37 | 32.83 | 43.21 | 43.17 | 32.83 | 36.59 | 40.09 | 39.24 | 42.57 |
| Total $\bar{X}$=55.19; S=5.93 | 56.12 | 52.44 | 58.40 | 60.78 | 67.19 | 56.40 | 57.86 | 60.16 | 67.15 | 58.51 |
| **Debt 1977 (in $)** | | | | | | | | | | |
| Direct Debt: Full Faith & Credit Pledge | | | | | | | | | | |
| General Obligation | 520,000 | 2,096,000 | 685,000 | 2,550,000 | 570,320 | 580,000 | 210,000 | 1,850,000 | 0 | 0 |
| Motor Vehicle Hwy. Fund | NA | 115,000 | NA | NA | 160,000 | 127,000 | NA | 90,000 | NA | NA |
| Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Direct Debt: No Tax Pledge | | | | | | | | | | |
| Special Assessment | NA | 214,000 | NA | 122,000 | 694,000 | 535,000 | NA | 460,000 | NA | NA |
| Tax Anticipation | NA | NA | NA | NA | NA | NA | 5,300,000 | 1,100,000 | NA | NA |
| Revenue Bonds | NA | NA | 15,000 | 200,000 | 240,000 | 30,000 | NA | NA | NA | NA |
| Bldg. Authority | NA | NA | NA | NA | 1,638,000 | NA | NA | NA | 249,000 | NA |
| Industrial Revenue Bonds | NA | 30,600,000 | NA | NA | NA | NA | NA | NA | NA | 625,000 |
| Other | 890,000 | 485,000 | NA | NA | NA | NA | NA | NA | NA | NA |

NA indicates "not available".

Table 7. Debt, taxes, and SEV (continued).

| | Belleville | Flat Rock | Gibraltar | Northville | Plymouth | Rockwood | Trenton | Woodhaven | Walled Lake | Novi |
|---|---|---|---|---|---|---|---|---|---|---|
| Overlapping Debt: FFC (In $) | | | | | | | | | | |
| School Debt | | | | | | | | | | |
| School District | 699,270 | 3,500,072 | 1,334,340 | 4,888,350 | 4,850,400 | 624,680 | 11,495,415 | 16,374,264 | 834,960 | 19,954,140 |
| Intermediate SD | 11,940 | 88,555 | 34,825 | 92,465 | 65,670 | 15,920 | 278,600 | 93,530 | 33,345 | 210,600 |
| Community College | 519,900 | 344,925 | 1,303,050 | 97,120 | 303,500 | 605,535 | 10,654,350 | 3,602,550 | 185,220 | 1,146,600 |
| Drains, County Share | 130,117 | 965,035 | 414,334 | 835,493 | 429,535 | 189,409 | 3,036,072 | 1,019,252 | 17,426 | 495,328 |
| Other | | | | | | | | | | |
| Overlapping Debt: No Tax Pledge (In $) | | | | | | | | | | |
| Revenue Bonds | * | * | * | 8,659 | * | * | * | * | * | * |
| Tax Anticipation | * | * | * | * | * | * | * | * | * | * |
| Industrial Revenue Bond | * | * | * | * | * | * | 5,850,000 | * | * | * |
| Other | 253,937 | 6,600 | * | * | * | * | * | * | * | 3,584 |
| Taxes per Capita (In $) | | | | | | | | | | |
| County | 40 | 127 | 80 | 47 | 53 | 42 | 88 | 55 | 34 | 39 |
| Township or City | 82 | 228 | 191 | 75 | 115 | 89 | 160 | 91 | 138 | 73 |
| School | 171 | 530 | 348 | 300 | 302 | 183 | 429 | 292 | 241 | 298 |
| Total | 295 | 886 | 620 | 422 | 470 | 314 | 679 | 438 | 413 | 411 |
| Total Debt (In $) | 3,025,164 | 38,415,187 | 3,786,549 | 8,794,087 | 10,241,425 | 2,707,544 | 36,824,437 | 24,589,596 | 1,380,951 | 22,435,252 |
| Less: Non-Tax Supported | 1,143,937 | 31,305,600 | 15,000 | 3,306,659 | 4,022,000 | 565,000 | 11,150,000 | 1,560,000 | 249,000 | 628,504 |
| Less: Revenue Supported | 130,117 | 1,080,035 | 414,334 | 835,493 | 429,535 | 316,409 | 3,036,072 | 1,109,252 | 78,426 | 495,328 |
| Net Debt: FFC | 1,751,110 | 6,029,552 | 3,357,215 | 8,456,603 | 5,789,890 | 1,826,135 | 22,638,365 | 21,920,344 | 1,053,525 | 21,311,340 |
| Total Debt (In $) | | | | | | | | | | |
| Per Capita | 966 | 5,547 | 878 | 1,300 | 853 | 752 | 1,212 | 1,481 | 306 | 1,066 |
| % SEV | 18.49 | 32.02 | 8.12 | 17.74 | 11.56 | 12.74 | 9.87 | 19.44 | 4.71 | 12.21 |
| Net Debt FFC (In $) | | | | | | | | | | |
| Per Capita x=793; s=375 | 559 | 870 | 779 | 1,176 | 482 | 507 | 745 | 1,320 | 233 | 1,012 |
| % SEV x=9.08; s=3.96 | 10.70 | 5.02 | 7.20 | 16.00 | 6.53 | 8.59 | 6.07 | 17.33 | 3.59 | 11.60 |
| Direct Debt FFC (In $) | | | | | | | | | | |
| Per Capita | 166 | 302 | 159 | 377 | 47 | 162 | 7 | 111 | 0 | 0 |
| % SEV | 3.1 | 1.7 | 1.5 | 5.1 | 0.64 | 2.7 | 0.06 | 1.5 | 0 | 0 |
| General Revenue (In $) | 502,382 | 2,224,076 | | 1,381,655 | 2,527,812 | 518,011 | 7,344,075 | 1,931,700 | 756,405 | 2,523,812 |
| Raised by Property Tax: Pct. (In %) | 5 | | | 36 | 55 | 48 | 69 | 71 | 43 | 56 |

* No data were found on file with the Michigan Municipal Fianance Commission.

Gibraltar, with a relatively low but rapidly rising income, has a debt ratio of $779. Continued income growth would make its debt position appear to be strong.

Woodhaven's net debt ratio of $1,320 per capita is second highest among cities and townships in the project area. The low income growth referred to earlier, and its relatively low State Equalized Value (SEV)[1] make it uncertain whether Woodhaven's debt position is sound.

Plymouth is another community showing possible signs of economic weakness. Its net debt ratio is only a third of Woodhaven's. SEV per capita is about the same as Woodhaven's, as is its total tax rate per capita. The two have the highest tax rates in the project area.

Belleville, Walled Lake, and Wolverine Lake Village are experiencing high population growth, but lower than average income growth. No debt data are available for Wolverine Lake. The net debt ratios of Belleville ($559) and Walled Lake ($233) are low. SEVs per capita, however, are also relatively low: $5,227 and $6,499 per capita, respectively. Belleville's tax rate per capita (56.12) is about average for the project area communities. Walled Lake, on the other hand, is among the highest in terms of total tax rates (67.15).

Rockwood, with a modest net debt ratio of $752 per capita is one of the fastest growing communities in terms of income. Its total tax rate (56.40) is about average in the project area.

The net debt ratio of Flat Rock ($870 per capita) is slightly higher than the average for the eleven communities. This is not considered especially significant when compared to its income growth experience which has been among the highest in the project area.

Data are incomplete for the various townships in the project area. Brownstown Township's net debt per capita ratio is over twice as high as the project area average Table 8. Commerce, Plymouth, and White Lake Townships have less than average levels of net debt per capita. Census Bureau population figures are not available for Huron, Sumpter, and Novi Townships; consequently, no net debt ratios are reported. For the remaining townships (Canton, Northville and Van Buren) there is no indication in their net debt ratios of unusual financial condition--an impression which is reinforced by the net debt as percent of SEV ratios.

A second ratio which provides a standard for evaluating the credit position of a community is the "net direct and overlapping tax-supported debt to adjusted assessed valuation. If reasonably accurate, this measure may be

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[1] State Equalized Valuation (SEV) is a measure which adjusts actual assessed valuation upward to approximate true market value. Thus it is possible to relate debt burden to the full value of taxable property in each community.

Table 8. Debt, taxes, and SEV for ten townships in the Huron Valley project area, Michigan (US Bureau of the Census 1961 and 1971; Verway and Grier 1977).

| | Brownstown | Canton | Huron | Northville | Plymouth | Sumpter | Van Buren | Commerce | Novi | White Lake |
|---|---|---|---|---|---|---|---|---|---|---|
| **Population, Projected** | | | | | | | | | | |
| **1977 Extrapolated from Regular Census** | 9,437 | 17,351 | NA | 13,213 | 21,178 | NA | 20,268 | 18,562 | NA | 21,293 |
| **State Equalized Valuation** | | | | | | | | | | |
| 1977 | 130,801,610 | 244,050,280 | 56,538,040 | 93,662,040 | 191,788,270 | 46,579,770 | 127,261,400 | 160,159,050 | 5,398,250 | 116,128,850 |
| SEV Per Capita | | | | | | | | | | |
| 1977 X = 9204; X = 3347 | 13,860 | 14,065 | NA | 7,088 | 9,056 | NA | 6,856 | 8,628 | NA | 7,802 |
| **Taxes** 1976 | | | | | | | | | | |
| County | 869,272 | 1,600,271 | 382,868 | 649,727 | 1,337,489 | 320,569 | 880,032 | 814,734 | 27,996 | 578,033 |
| **Township** | 574,159 | 1,353,444 | 703,022 | 214,576 | 593,657 | 313,370 | 860,268 | 214,012 | 13,787 | 307,266 |
| School | 4,441,663 | 9,137,521 | 1,567,836 | 3,708,385 | 7,627,397 | 1,388,983 | 3,816,873 | 5,876,641 | 208,529 | 4,258,004 |
| Total | 5,885,095 | 12,091,237 | 2,653,727 | 4,572,689 | 9,558,544 | 2,022,927 | 5,557,175 | 6,905,388 | 250,313 | 5,143,305 |
| **Tax Rates** 1976 | | | | | | | | | | |
| County | 7.57 | 7.57 | 7.57 | 7.57 | 7.57 | 7.57 | 7.57 | 5.51 | 5.51 | 5.51 |
| **Township** | 5.00 | 6.40 | 13.90 | 2.50 | 3.36 | 7.40 | 7.40 | 1.45 | 2.71 | 2.93 |
| School | 38.68 | 43.22 | 31.00 | 43.21 | 43.17 | 32.80 | 32.83 | 39.74 | 41.04 | 40.59 |
| Total | 51.25 | 57.20 | 52.47 | 53.28 | 54.10 | 47.77 | 47.80 | 46.70 | 49.26 | 49.03 |
| Debt 1977 | | | | | | | | | | |
| Direct Debt: Full Faith & Credit Pledge | 0 | * | 0 | 0 | 0 | 0 | * | 0 | | 0 |
| General Obligation | * | 1,115,000 | * | * | * | * | 4,600,000 | * | * | * |
| **Motor Vehicle** / Tag Fund | * | * | * | * | * | * | * | * | * | * |
| Other | | | | | | | | | | |
| Direct Debt: No Tax Pledge | * | * | 0 | * | 0 | 0 | * | 0 | 0 | * |
| Special **Assessment** | 65,000 | 186,000 | * | 290,000 | * | * | * | * | * | * |
| **Tax** Anticipation | * | 6,400,000 | * | * | * | * | 1,594,000 | * | * | * |
| **Revenue** Bonds | * | * | * | * | * | * | * | * | * | 1,600,000 |
| Building Authority | * | * | * | * | * | * | * | * | * | 150,000 |
| Industrial **Revenue** Bonds | * | * | * | * | * | * | * | * | * | * |
| Overlapping **Debt**: **FFC** | | | | | | | | | | |
| School Debt | | | | | | | | | | |
| School District | 11,477,152 | 14,457,172 | 9,088,076 | 8,889,750 | 10,462,200 | 2,085,445 | 5,481,050 | 6,026,690 | 401,959 | 7,834,603 |
| Intermediate SD | 96,515 | 179,100 | 41,790 | 21,890 | 139,300 | 34,825 | 95,520 | 184,275 | 6,142 | 131,625 |
| Community College | 3,755,850 | 831,590 | 153,300 | 321,710 | 655,560 | 1,303,050 | 3,602,550 | 1,014,300 | 35,280 | 749,700 |
| **Drains**, County Share | 1,051,782 | 1,951,760 | 455,410 | 238,548 | 151,803 | 379,509 | 1,040,939 | 433,412 | 14,447 | 309,580 |
| Other | | | | | | | | | | |
| Overlapping **Debt**: No Tax Pledge | | | | | | | | | | |
| **Revenue** Bonds | * | * | * | 14,999 | * | * | * | * | * | * |
| **Tax** Anticipation | * | * | * | * | 2,782,500 | 229,090 | * | * | * | * |
| Industrial Revenue Bond | * | * | * | * | * | * | * | * | * | * |
| Other | * | 3,182,731 | * | 112,500 | * | 380,906 | 337,458 | * | * | * |

* No data were found on file with the Michigan Municipal Finance Commission.

NA indicates "not available".

Table 8. Debt, taxes, and SEV (concluded).

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| | Brownstown | Canton | Huron | Northville | Plymouth | Sumpter | Van Buren | Commerce | Novi | White Lake |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxes per Capita | | | | | | | | | | |
| County | 92 | 92 | NA | 49 | 63 | NA | 47 | 44 | NA | 27 |
| Township | 61 | 78 | NA | 16 | 28 | NA | 46 | 12 | NA | 14 |
| School | 471 | 527 | NA | 281 | 360 | NA | 206 | 317 | NA | 200 |
| Total | 624 | 697 | NA | 346 | 451 | NA | 298 | 372 | NA | 242 |
| Total Debt | | | | | | | | | | |
| Less: Non-tax supported | 16,446,299 | 28,303,353 | 9,738,576 | 9,889,397 | 14,191,363 | 4,412,825 | 16,751,597 | 7,658,677 | 457,828 | 10,775,508 |
| Less: Revenue supported | 65,000 | 9,768,731 | 0 | 417,499 | 2,782,500 | 609,996 | 1,931,538 | 0 | 0 | 1,750,000 |
| Net Debt: FFC | 1,051,782 | 1,951,760 | 455,410 | 238,548 | 151,803 | 379,509 | 1,040,939 | 433,412 | 14,447 | 309,580 |
| | 15,379,517 | 16,582,862 | 9,283,166 | 9,233,350 | 11,257,060 | 3,423,320 | 13,779,120 | 7,225,265 | 443,381 | 8,715,928 |
| Total Debt | | | | | | | | | | |
| Per Capita | 1,742 | 1,631 | NA | 748 | 670 | NA | 902 | 412 | NA | 506 |
| % SEV | 12.57 | 11.60 | 17.22 | 10.56 | 7.40 | 9.47 | 13.16 | 4.78 | 8.48 | 9.28 |
| Net Debt FFC | | | | | | | | | | |
| Per Capita r=70 | 1,624 | 955 | NA | 698 | 531 | NA | 742 | 399 | NA | 409 |
| % SEV y=3.07 + .007x | 11.74 | 6.79 | 16.42 | 9.86 | 5.87 | 7.35 | 10.83 | 4.51 | 8.21 | 7.50 |
| Direct Debt FFC | | | | | | | | | | |
| Per Capita | 0 | 64 | 0 | 0 | 0 | 0 | 247 | 0 | 0 | 0 |
| % SEV | 0 | 0.45 | 0 | 0 | 0 | 0 | 3.60 | 0 | 0 | 0 |
| General Revenue | 829,808 | 1,930,878 | 586,587 | 629,307 | 1,358,359 | NA | 1,406,348 | 893,307 | 26,963 | 1,018,310 |
| Raised by Property Tax: Pct. $\bar{x}=36.9$ $s=20.3$ | NA | 49 | 11 | 41 | 24 | | 16 | 23 | 26 | 17 |

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superior to a per capita ratio because the debt burden is being related directly to the most important taxable base within the community" (Moak and Hillhouse 1975). It is useful when property tax is a major source of revenue to the community (30% or more). Nine of the communities in the project area raise 30% or more of their general revenue via taxation (predominantly the property tax, although taxation by type of tax is not indicated in all the audited reports). The percentages are presented in Tables 7 and 8. The entry titled "Net Debt FFC, % SEV" presents data on the net debt backed by full faith and credit pledge as a percentage of State equalized valuation for the communities in the project area. The mean percentage is 9.08%. There is considerable variability in the values for this ratio, just as there is in the per capita ratio. The correlation between the two ratios is fairly high (0.70). Nevertheless, they are sufficiently distinct to warrant separate consideration.

The communities which have the highest net debt in relation to SEV are Northville, Woodhaven, and Huron Township. The percentages are 16.0, 17.3, and 16.4. Taxes (predominantly on property) account for 36% of general revenue in Northville and 71% in Woodhaven. They account for only 11% in Huron Township. In Huron, because property taxes do not account for much of general revenue, the relatively high utilization of the property tax base may not be an important indicator of their ability to support new debt. In Woodhaven, on the other hand, the great importance of the property tax and the high existing utilization of the tax base, may be yet another reason to question Woodhaven's ability to support major new debt.

Some communities have not exploited the tax base to a great extent to support debt, but rely on taxes as a revenue source. Such communities would seem to have room in their financial structure to support new debt, so far as the SEV criterion is concerned. Canton, Plymouth, Trenton, and Walled Lake are such communities.

Among communities which have exploited their property tax base in support of debt only to a small extent relative to the entire project area are Commerce and Plymouth Townships. Their net debts as a percentage of SEV are only 4.51 and 5.87 percent respectively. General revenue raised by taxation is also relatively low in these communities: 23% and 24% respectively.

Canton and Northville Townships both have relatively high percentages of general revenue raised by property taxation; net debt as a percentage of SEV is not high by comparison with the other communities.

Tax data for Brownstown and Sumpter Townships are not available. The remaining townships--Van Buren, Novi, and White Lake--make less than average use of the property base in support of debt.

## 3.2. Land Use and Transportation

### 3.2.1. General Land Use

Land use has been changing from rural to suburban as the Detroit Metropolitan area has expanded into the project area. Land use for Oakland County and Wayne County (excluding Detroit) for 1953 and 1965 are listed below (SEMCOG 1968):

| Type of Land Use | Wayne County (Excluding Detroit) |  | Oakland County |  |
|---|---|---|---|---|
|  | 1953 (sq. mi.) | 1965 (sq. mi.) | 1953 (sq. mi.) | 1965 (sq. mi.) |
| Residential | 77.4 | 115.6 | 72.2 | 128.4 |
| Commercial | 8.7 | 12.4 | 5.1 | 14.8 |
| Industrial | 14.2 | 22.1 | 5.4 | 12.4 |
| Public Oriented Land | 22.0 | 36.3 | 8.8 | 26.6 |
| Recreational | 6.2 | 18.4 | 41.8 | 57.3 |
| Vacant Land | 334.8 | 257.0 | 710.4 | 606.5 |

Residential, commercial, industrial, public, and recreation acreage increased during this period at the expense of vacant land. The vacant land was primarily agricultural.

Since World War II, large industries have tended to locate on relatively inexpensive land in rural areas. Industrial development in the project area generally preceded residential and commerical growth (Enviro Control, Inc. 1976).

Land use in the project area falls into three major zones. These zones are (Enviro Control, Inc. 1976):

- Predominantly built-up areas containing continuous residential areas, munufacturing plants, commercial nodes and strips and scattered areas of agricultural land, most of which is inactive

- Isolated residential subdivisions and inactive agricultural land with some scattered large parcels of manufacturing land

- Actively used agricultural land with widely dispersed residential land, most of which represents single dwellings or strips of dwellings along highways where small cross roads, nuclei of dwellings, and commercial establishments occur.

### 3.2.2. Existing Land Use

Specific data on project area land use have been obtained from the SEMCOG 1975 Land Use Inventory (1978). The information has been summarized and is presented on the following page.

|  | Land Use Category |  |  |  |  |
|---|---|---|---|---|---|
|  | Commercial/ Industrial/ Institutional (acres) | Residential (acres) | Agricultural (acres) | Vacant (acres) | Recreational (acres) |
| White Lake Twp. | 142 | 2,821 | 2,844 | 10,584 | 4,512 |
| Commerce Twp. | 326 | 2,647 | 2,280 | 7,646 | 3,243 |
| Wolverine Lake | 15 | 598 | 3 | 181 | 6 |
| Walled Lake | 209 | 440 | 0 | 621 | 26 |
| Novi | 360 | 3,276 | 2,175 | 11,425 | 319 |
| Northville | 137 | 584 | 45 | 289 | 75 |
| Northville Twp. | 275 | 1,767 | 2,030 | 3,714 | 1,586 |
| Plymouth | 345 | 794 | 0 | 90 | 70 |
| Plymouth Twp. | 629 | 2,136 | 2,136 | 4,157 | 398 |
| Canton Twp. | 378 | 3,150 | 9,439 | 7,370 | 389 |
| Van Buren Twp. | 1,294 | 2,403 | 7,278 | 8,609 | 953 |
| Belleville | 36 | 333 | 0 | 169 | 18 |
| Sumpter Twp. | 34 | 1,927 | 9,911 | 6,633 | 118 |
| Huron Twp. | 76 | 1,783 | 10,288 | 7,910 | 1,854 |
| Flat Rock | 229 | 577 | 1,293 | 1,626 | 68 |
| Rockwood | 54 | 261 | 283 | 710 | 48 |
| Gibraltar | 142 | 369 | 80 | 1,490 | 38 |
| Woodhaven | 591 | 712 | 1,058 | 1,286 | 26 |
| Trenton | 857 | 1,594 | 1,043 | 2,230 | 403 |
| Brownstown Twp. | 104 | 1,071 | 3,016 | 3,588 | 168 |
| South Rockwood | 24 | 161 | 461 | 540 | 158 |
|  | 6,257 | 29,404 | 55,663 | 80,868 | 14,476 |

## Oakland County

White Lake and Commerce Townships have large areas of open space and some small farm areas. Commerce Township has experienced more residential development than White Lake Township. The eastern part of Novi is dominated by residential subdivisions. Some open space and small farms are in the western part of Novi. Overall, major residential development in Oakland County has been concentrated around the lake areas (examples are the communities of Wolverine Lake and Walled Lake). Other concentrations of development have occurred along the major roads (Enviro Control, Inc. 1976).

## Wayne County

The eastern sections of Plymouth and Northville Townships are mostly residential. Brush and wooded areas occur throughout both townships while agricultural land is found in the western section. The northeastern part of Canton Township consists of a few large residential tracts, while large amounts of agricultural land and scattered residential developments are found in the remaining areas of the township.

Residential, commercial, and industrial developments occur uniformly along the east-west axis of Van Buren Township. This pattern of development reflects Van Buren Township's location between Detroit and the Ann Arbor/ Ypsilanti area. Most development has occurred near Belleville Lake and along the major roadways connecting Detroit with Ann Arbor and Ypsilanti. Agricultural land is located in the southwestern part of the Township. Land use in Sumpter and Huron Townships is characterized by active cropland and widely scattered developed areas. Sumpter Township is the least developed area in the Wayne County section of the project area (Enviro Control, Inc. 1976).

The southeastern part of the project area includes Brownstown Township and the Cities of Flat Rock, Gibraltar, Rockwood, Trenton, and Woodhaven. The areas in close proximity to the Huron River are urbanized. The remainder of the area is under a variety of uses ranging from agriculture to industry.

### 3.2.3. Recreational Land

Recreational areas are a major land use in parts of the project area. State Recreation Areas are located in the western parts of White Lake and Commerce Townships. The Middle Rouge and Cass Benton Parkways are in the vicinity of Plymouth and Northville. Several metroparks are located in the project area. The Lower Huron Metropark is located along the Huron River east of Belleville. It encompasses 1,200 acres. Willow Metropark is adjacent to the Lower Huron Metropark and includes 1,500 acres. The Oakwoods Metropark is adjacent to Willow Metropark and includes 1,700 acres (Enviro Control, Inc. 1976).

### 3.2.4. Housing

Information on occupied housing units between 1970 and 1975 is presented in Table 9. The data include the number of persons per occupied dwelling unit and the change in the number and percent of occupied dwelling units between 1970 and 1975. The Huron Valley project area had an increase of 51.1% in the number of occupied dwelling units during the five-year period. This is much higher than the increase that occurred in the SEMCOG Region (10.2%), Oakland County (19.3%), and Wayne County (3.1%). The number of occupied dwelling units decreased in the City of Detroit by 3.1%, representing a loss of 18,521 occupied units.

The number of persons per occupied dwelling unit decreased in all of the jurisdictions except Woodhaven (Table 9). During 1975, the number of persons per occupied dwelling unit was highest in the Huron Valley project area (3.22), compared to the SEMCOG Region (3.03), Oakland County (3.07), Wayne County (2.94), and Detroit (2.78).

Within the Huron Valley project area, the greatest increases in occupied dwelling units between 1970 and 1975 occurred in Canton Township (200.5%), Brownstown Township (153.0%), Woodhaven (129.0%), and Novi (122.4%). The least significant changes occurred in Plymouth (4.2%), Huron Township (9.1%), Sumpter Township (13.2%), and Rockwood (16.4%).

Table 9. Occupied dwelling units in the Huron Valley project area, Michigan (SEMCOG 1976d). An asterisk [*] denotes a community not included in the project area total.

| | Persons/Occupied Dwelling Unit | | Number of Occupied Dwelling Units | | | |
|---|---|---|---|---|---|---|
| | 1970 | 1975 | 1 April 1970 | 1 July 1975 | Number | Percent |
| SEMCOG Region | 3.33 | 3.03 | 1,424,237 | 1,569,100 | 144,863 | 10.2 |
| Wayne County | 3.22 | 2.94 | 831,609 | 857,200 | 25,591 | 3.1 |
| Detroit | 3.04 | 2.78 | 498,621 | 480,100 | -18,521 | -3.7 |
| Oakland County | 3.42 | 3.07 | 265,741 | 317,000 | 51,259 | 19.3 |
| Project Area | 3.71 | 3.22 | 49,972 | 75,490 | 25,518 | 51.1 |
| Commerce Twp. | 3.79 | 3.48 | 3,839 | 4,690 | 851 | 22.2 |
| Wolverine Lake | 3.73 | 3.46 | 1,155 | 1,460 | 305 | 26.4 |
| Novi and Novi Twp. | 3.68 | 2.91 | 2,676 | 5,950 | 3,274 | 122.4 |
| Northville (part) | 4.18 | 3.74 | 566 | 770 | 204 | 36.1 |
| Walled Lake | 3.53 | 2.98 | 1,065 | 1,590 | 525 | 49.3 |
| White Lake Twp. | 3.56 | 3.31 | 4,025 | 5,300 | 1,275 | 31.7 |
| Brownstown Twp. | 3.45 | 3.01 | 2,055 | 5,200 | 3,145 | 153.0 |
| Flat Rock | 3.63 | 3.21 | 1,554 | 2,050 | 496 | 31.9 |
| Gibraltar | 3.47 | 3.15 | 1,106 | 1,480 | 374 | 33.8 |
| Rockwood | 3.64 | 3.20 | 885 | 1,030 | 145 | 16.4 |
| Canton Twp. | 3.38 | 3.35 | 3,261 | 9,800 | 6,539 | 200.5 |
| Huron Twp. | 3.83 | 3.52 | 2,099 | 2,290 | 191 | 9.1 |
| Northville Twp. | 5.40 | 3.77 | 1,762 | 3,300 | 1,538 | 87.3 |
| Northville (part) | 2.80 | 2.51 | 1,082 | 1,150 | 68 | 6.3 |
| Plymouth Twp. | 3.56 | 3.19 | 4,909 | 6,100 | 1,191 | 24.3 |
| Plymouth | 3.13 | 2.82 | 3,762 | 3,920 | 158 | 4.2 |
| Sumpter Twp. | 3.72 | 3.46 | 2,173 | 2,460 | 287 | 13.2 |
| Trenton | 3.69 | 3.23 | 6,530 | 7,550 | 1,020 | 15.6 |
| Van Buren Twp. | 3.67 | 3.15 | 3,590 | 5,550 | 1,920 | 54.6 |
| Belleville | 2.90 | 2.37 | 830 | 1,450 | 620 | 74.7 |
| Woodhaven | 3.40 | 3.41 | 1,048 | 2,400 | 1,352 | 129.0 |
| South Rockwood* | 3.82 | 3.50 | 387 | 400 | 13 | 3.4 |

Housing values for Michigan and the US are presented in Table 10. In 1970, the eleven cities (only units for which data are available) had a "mean median value" of $22,936, which was greater than that of the State and Nation. Only two communities, Belleville and Walled Lake, had values less than the State average.

Table 10. Median values for existing FHA-insured homes in Michigan and the US during 1970 to 1973 and during 1975 (Verway and Grier 1977).

| | 1970 | 1971 | 1972 | 1973 | 1975 | $\bar{X}$ |
|---|---|---|---|---|---|---|
| MICHIGAN | 19,514 | 20,504 | 19,898 | 17,488 | 20,231 | 19,527 |
| US | 17,764 | 18,904 | 19,331 | 18,737 | 26,051 | 20,157 |

### 3.2.5. Transportation

The project area is served by four Interstate highways. Segments of Interstates 96 and 275 recently have been completed and potentially may induce new development in the Oakland County and western Wayne County sections of the project area. Interstate 94 runs through Van Buren Township and connects Detroit with Ann Arbor, Ypsilanti, and eventually Chicago. Interstate 75 transects the southeastern section of the project area and is the major artery connecting Detroit with points south. In addition to the Interstate highways, there are other major Federal and State highways that serve the project area.

Public bus and rail service is extremely limited in the project area. Bus service is provided by the Southeastern Michigan Transportation Authority (SEMTA) and service is not extensive. Commuter rail service is not available at present although an Amtrak commuter train crosses the project area on its Ann Arbor-Detroit routes.

Air service is available at the Willow Run Airport (Northwest of Belleville) and the Detroit Metropolitan Airport (adjacent to the project area in Romulus). The Detroit Metropolitan Airport provides international service for the southeastern Michigan region.

## 3.3. Cultural, Historic, and Archaeological Resources

### 3.3.1. Prehistory of the Project Area

Although few archaeological surveys have been made in the project area, the potential for sites is great (Figure 6). The numerous glacial lakes in Oakland County provided ideal sites for Indian life. According to local archaeologists, the area along the Huron River downstream from New Boston may be one of the most significant archaeological regions in southeastern Michigan.

Artifacts dating from the period known as the Late Archaic have been found in southeastern Michigan, including the Warner School site in Oakland County (Fitting 1970). An archaeological survey for I-275 by Commonwealth Associates Inc. (1974) identified six sites which are in the Huron Valley project area. One site (I-275-2) is in Van Buren Township, Section 13, SE 1/4. Surficial material collected included historic ceramic and prehistoric chippage, and argilite points. Site I-275-7 is located in Van Buren Township, Section 18, NW 1/4, SW 1/4. Cultural material from the site includes ceramics, Atlantic Coast shells, bone fragments, and flint chippage. Another site, I-275-4, is located in Huron Township, Section 16, SW 1/4, SW 1/4. Material from this site includes historic ceramics, bone, chippage, and stone tools. The "old Indian Improvements" site is located in Huron Township, Section 16. This site is taken from the Hubbard Map Series for Michigan which indicated Indian improvements on the north side of the Huron River. The Rennie Site is located in Huron Township, Section 27, NE 1/4, SW 1/4. This site is located on the Wyandot Reservation site and contains extensive surface material. The sixth site is located in Huron Township, Sections 22 and 27. The site first was recorded in 1964. Artifacts included triangular points and other Late Woodland material, fire-cracked rock and flakes, and surface-recovered human bone.

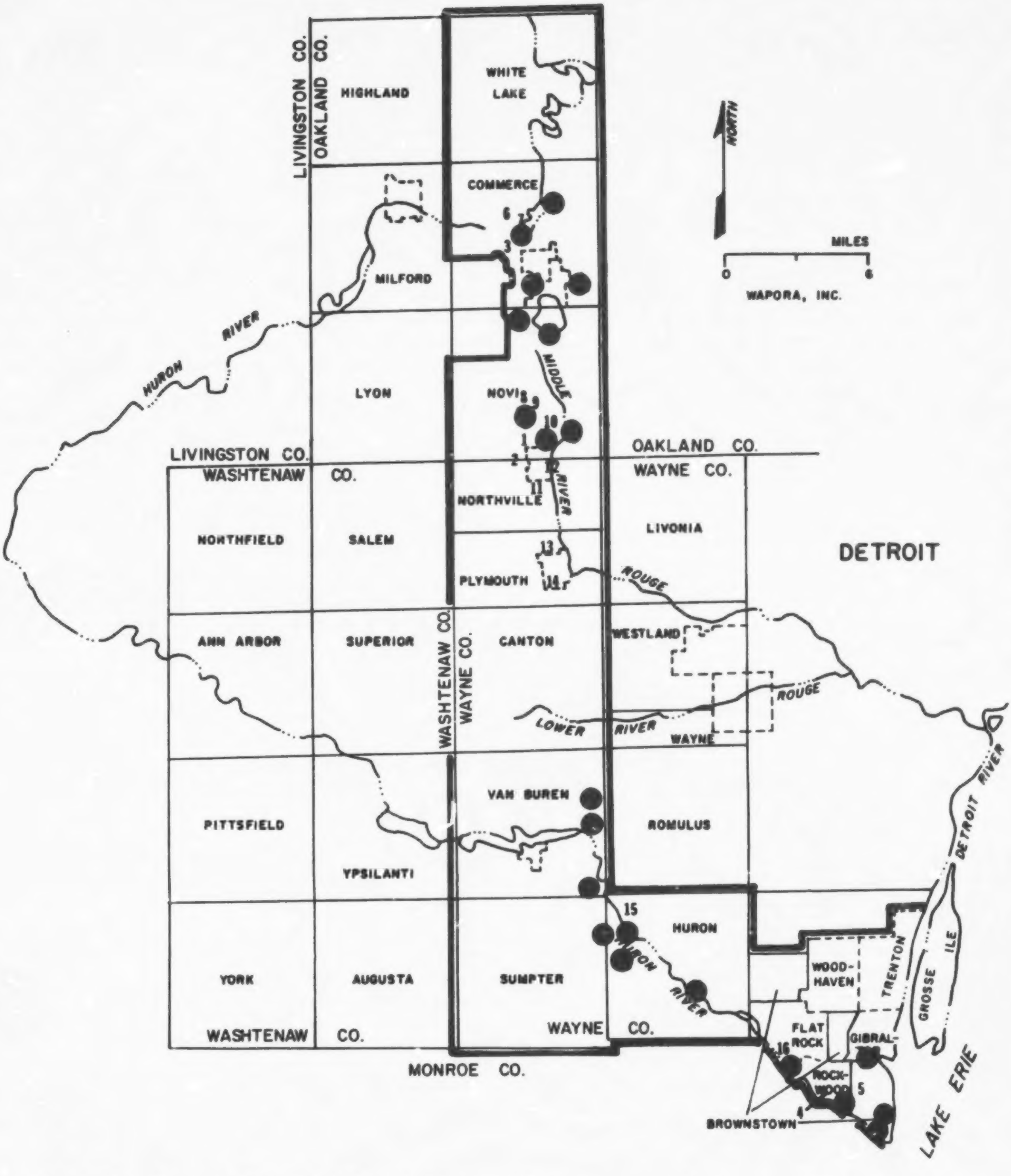
LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
NORTH
MILES
0
6
WAPORA, INC.
COMMERCE
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
RIVER
NORTHVILLE
NORTHFIELD
SALEM
LIVONIA
DETROIT
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
ROUGE
LOWER
RIVER
WAYNE
VAN BUREN
PITTSFIELD
ROMULUS
DETROIT RIVER
YPSILANTI
HURON
HURON RIVER
YORK
AUGUSTA
SUMPTER
WOOD-HAVEN
TRENTON
GROSSE ILE
WASHTENAW CO.
WAYNE CO.
FLAT ROCK
GIBRAL-TAR
ROCK-WOOD
MONROE CO.
BROWNSTOWN
LAKE ERIE
1
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Figure 6. Documented and potentially significant archaeological, cultural, historical, and architectural sites. The general locations of potential archaeological resources are indicated with black dots. Documented cultural, historic, and architectural sites are numbered 1 through 5. Potential sites are numbered 6 through 16.

Four of the above sites are located in the Willow Metropark, through which the proposed interceptor would be constructed. Preliminary surveys have identified 21 sites in Willow Metropark and 8 sites in Oakwoods Metropark (By letter, 28 February 1978, Mr. Thomas H. Smith, Huron-Clinton Metro-Authority).

A site in Gibraltar was discovered in the 1940s and produced artifacts dated between 600 and 900 A.D. A similar find was made in 1944 at Springwell, immediately north of the project area. Neither site has been preserved (Fitting 1970).

The other locations shown on Figure 6 were provided by local residents and historians. One site, the "wall", for which Walled Lake is named, has caused substantial debate. Situated west of the lake, the wall extends for some 1,600 feet, and is 4.0 feet high, 5 to 10 feet thick, with a top of earth and soil. Local legend attributes the wall to Indian artisans. Other theories suggest the wall is a glacial drift deposit or is the result of the displacement of rocks from the lake by ice during winter.

### 3.3.2. History of the Project Area

The French were exploring the area around Sault Ste. Marie at the same time pilgrims were arriving in Massachusetts. Circa 1620, Samuel de Champlain was exploring Michigan (May 1967). Not until 1679, however, was a visit to southeast Michigan by "white men" documented in writing. Father Hennepin, who accompanied La Salle on his explorations, visited the region now occupied by the Detroit metropolitan area. This combination missionary/explorer was typical of French entrepreneurs in America who capitalized on the fur trade.

On 24 July 1701, a group of French and Indians led by Antoine de la Mothe Cadillac founded Fort Pontchartrain du Detroit (shortened to Detroit in 1751). The settlement was established as an outpost to demonstrate the power of the French and as a center for French commerce in the Great Lakes region (Parkins 1918). Southeast Michigan remained unsettled during this time primarily because the region was frequented by the hostile Iroquois tribe. This alone served to discourage any settlement beyond the protection of Detroit.

The French and Indian War, the Indian Revolt of 1763, the Revolutionary War, and the War of 1812 were important influences on the Detroit region, as the area passed from Indian to French to British to American control (back to the British briefly in 1813). Not until the 1820s did southeastern Michigan begin to attract significant numbers of settlers. In the mid-1820s the Erie Canal was completed. By the 1840s, most of the Indian tribes (Huron, Ottawa, Miami, Chippewa, and Potawatomi) had left Michigan.

Initially, white settlements developed along the rivers of the area, including the Huron, Rouge, and Raisin. This cheap source of power attracted manufacturing to the area. By 1893, a manufacturing network had sprung up along the rivers. Added to very favorable locations on both rail and water routes were low taxes, inexpensive water and fuel, and vacant land (Secretary of the State of Michigan 1893). Henry Ford took advantage of this situation in the 1920s and established industry in towns such as Northville and Plymouth.

Due to the growth of the Detroit metropolitan area, few vestiges of early settlement in Rockwood, Flat Rock, and New Boston remain. Plymouth, Northville, and to a lesser extent Walled Lake, however, contain extensive areas which convey distinct historical perspectives. Current Michigan law (Public Act No. 169) permits localities to declare historic districts within their boundaries. To date only Northville has taken advantage of this. Novi and Commerce are rapidly losing their few remaining connections with early settlement patterns, as suburban development encroaches on the lakes region. In the rural sections of the project area there remain a relatively large number of original farmsteads, some qualifying as Michigan Centennial Homes. The rural areas around Northville, Plymouth, and Novi contain excellent examples of early settlement types, as does the area north of New Boston along Hannan Road.

### 3.3.3. Cultural, Historical, and Architectural Sites in the Project Area

Two sites located in the project area are listed in the National Register of Historic Places. These sites, both in Northville, are the Robert Yerkes House and the Northville Historic District. Figure 6 shows these sites and others described in the following paragraphs.

The Robert Yerkes House (Site #1), located at 535 E. Base Line Road in Northville, Oakland County, has been chosen for inclusion in the National Register because of its architectural significance. This building, constructed in 1869, is a Gothic cottage with highly ornamental gables in the facade. Site #2 is the Northville Historic District. It is a 20 block area encompassing the original 1840 town plat in Wayne County. According to the Northville Historical Society, there are 73 buildings in the District which possess architectural and historical significance of at least a local level. Although the majority of the buildings are frame gothic cottages constructed between 1860 and 1870, there are some Greek revival buildings of the 1830s still standing and also examples of Queen Anne, Italianate, and early 1900s bungalows. When the Michigan History Division, Michigan Department of State, recommended that the Northville Historic District be included in the National Register of Historic Places, it noted the "quiet, nineteenth century aura" which still pervades the District.

Three sites in the project area are listed in the Michigan History Division's State Register of Historic Sites. They include the two National Register sites and the Byers Farm.

The Byers Farm (Site #3) is situated on the east side of the Huron River near the intersection of Commerce and S. Commerce roads (213 Commerce). The homestead is reputed to be the site of the first "white" settler in Commerce Township, Abram Walrod. The present frame house was erected circa 1850. Most of the original mid-nineteenth century buildings still stand. The farm now functions as an antique store.

According to the Monroe County Historical Commission, there are two sites situated along the Lower Huron River that possess cultural, historical, or architectural significance. These sites are the United Methodist Church in South Rockwood Village and a residence on South Huron River Road, Rockwood.

Site #4 is the United Methodist Church located at 6311 South Huron River Drive. It was built shortly after 1884. The land and most of the money to build the church were donated by John Strong. John Strong founded South Rockwood in the 1860s. Architecturally, the Monroe County Historical Commission considers this church one of the finer structures of its type in the area.

Sites #5 is a residence located at 5617 South Huron River Drive. It currently is owned by the Wesburn Golf and Country Club. The building formerly was associated with the Walthers family, and its date of construction may be in the late 1820s. This would make it one of the oldest structures in the State. The Monroe County Historical Commission considers this architecturally significant.

In addition to the above culturally, historically, or architecturally significant sites, there are two sites in the project area noted by the Historic American Engineering Record as possessing significance. These are the Detroit, Toledo, and Ironton Railroad Flat Rock Bridge-Dam structure on the Huron River and the former Alter Motor Car Company in Plymouth.

Throughout the project corridor small community or family cemeteries are found. Many possess local historical significance as they are permanent records of the earliest settlers, including Revolutionary War, War of 1812, and Civil War veterans. Cemeteries usually are not considered for National Register eligibility. Their significance would lie in their relationship to remaining pioneer sites and/or historic districts.

A windshield survey of the project area (WAPORA 1978) identified eleven potential sites of cultural, historical, or architectural significance in addition to the five sites listed above. Located on Bogie Lake Road just north of Commerce is the Commerce Methodist Church (Site #6), founded in 1841. Several hundred feet southeast of the Methodist Church is a large, rambling frame house (Site #7), located at 722 Farr Street. Site #8, a residence, is located at 43707 Grand River Road in Novi and is one of a few remaining architecturally significant structures in the area. A house on Grand River Road east of Novi Road (Site #9) is indicative of the Stick style of architecture. The owner of the building estimated its construction at circa 1880. Site #10 is located on the northeast corner of 9-Mile Road and Novi Road north of Northville. The site is the original farm of Charles Thornton, one of the early settlers in the area. Only limited local significance may be ascribed to this site owing to extensive site alterations.

Site #11 is situated within the limits of the Northville Historic District, but is a separate entity. Mill Race Historical Village is a result of efforts by the Northville Historical Society to retain examples of bygone eras which were in danger of being destroyed. As a result, the Historical Village is a collection of buildings moved to the approximately 10-acre site west of Griswold, south of the millpond dam, and running adjacent to the millrace. At present there are five significant structures in the village, with space reserved for three or four more. The extant structures are:

1) Wash Oak School - Built in 1873.

2) Old Library Building - Built in 1845.

3) Hunter House - Built in 1851.

4) Yerkes House - Built circa 1858.

5) Cottage Victorian House - Built circa 1890.

The site of the village was the original location of the first grist mill in Northville. Today, the water wheel is used rarely by the Northville Valve Plant (Ford's original industry in Northville) adjacent to the site.

The Middle River Rouge from Northville to Plymouth was used to power several mills in the 1800s. They were: Mead's Mill, Phoenix Mill, Gunsolly Mill, and Northville and Plymouth Mills. Only the sites remain today.

Site #12 is an Italianate-style residence located on 8-Mile Road, 0.25 mile east of Northville. Sites #13 and #14 are located within Plymouth. Site #13 is Old Village in Plymouth, an area bounded roughly by Wilcox Road on the north, the River Rouge on the east, Plymouth Road on the south, and York Street on the west. This area appears to include several sites of cultural, historical, or architectural significance and may qualify as a historic district. There are two other areas in Plymouth, however, which also contain a large number of potentially significant sites: Renniman Avenue and central Plymouth. Site #14 is a Greek Revival structure situated at the corner of Wilcox and Hardenberg Streets. Referred to as the Guenther or Wilcox House, it was associated with the mill on the River Rouge. This site possesses limited local significance but would compliment a historic district as one of the few remaining Greek Revival structures in Plymouth.

Site #15 is an unusual structure at 17620 Hannan Road in rural New Boston. No information was available on the origin of this structure. However, despite its obscure historical connections, the house is architecturally significant at the local and possibly regional level due to the lack of similar structures in the area. Site #16, a frame house, is located at 28911 Seneca in Flat Rock.

## 3.4. Wastewater Collection and Treatment Systems

Most of the more populated parts of the project area are sewered and belong to an established sewage collection district (Figure 7). This is especially true of the southern section of the project area. Exceptions are Sumpter Township in Wayne County, and White Lake and Commerce Townships in Oakland County which are entirely unsewered. Individual on-lot septic systems are being utilized for sewage disposal in these and other unsewered sections of the project area. The following subsections describe the existing wastewater control systems, beginning with the northern section of the project area.

### 3.4.1. Walled Lake-Novi Wastewater Control System

This system consists of sanitary collector sewers and a tertiary WWTP which serves all of the City of Walled Lake and the northeastern section of the City of Novi in Oakland County. Service area population was estimated to be 9,000 in 1977.

The system was constructed by the Oakland County Department of Public Works during 1970 and 1971, replacing the use of individual septic tank, tile-field disposal systems. The system is designed to provide service to all existing buildings and vacant platted lots in the established service area.

The Walled Lake WWTP is located in Novi immediately southwest of Walled Lake. The plant is designed to treat a flow of 1.5 mgd from a tributary population of 14,000. Flow to the WWTP during 1977, however, was considerably less than design capacity, averaging 1.0 mgd. System infiltration is less than 0.13 mgd. Wet weather has no significant effect on the system (Oakland County DPW 1975). Provision was made in the design and construction for future expansion to 2.1 MGD for a population of 21,000.

The WWTP is operated by the Oakland County DPW. The plant is in good physical and operational condition. The facility utilizes an activated sludge process followed by multimedia tertiary filters. Alum is added prior to aeration for phosphorus removal. Influent wastewater characteristics are: 250 mg/l $BOD_5$; 250 mg/l SS; 8.0 mg/l total P; and pH 7.0 (Hubbell, Roth & Clark, Inc. 1976). Sludge is processed by aerobic digestion and dewatered on sludge drying beds. Characteristics of the sludge are listed in Table 11. Annual sludge production is estimated to average 210 tons on a dry weight basis. Flow equalization is utilized to load the tertiary filters at a constant rate. Final effluent is chlorinated to provide disinfection and odor control. The land area of the plant is approximately 11 acres.

The effluent discharged from the treatment plant to Fenley Drain, tributary to the Walled Lake Branch of the Middle River Rouge, is regulated by NPDES Permit No. MI 0024287 issued by the Michigan Water Resources Commission (MWRC).

# TABLE OF CONTENTS

Page

COVER SHEET . . . . . . . . i 1/A5

TABLE OF CONTENTS . . . . . . . . iii 1/A7

LIST OF TABLES . . . . . . . . vii 1/A11

LIST OF FIGURES . . . . . . . . viii 1/A12

LIST OF ABBREVIATIONS . . . . . . . . ix 1/A13

GLOSSARY OF GEOGRAPHICAL TERMS . . . . . . . . x 1/A14

SUMMARY . . . . . . . . xi 1/B1

1.0. INTRODUCTION . . . . . . . . 1 1/B12
  1.1. Proposed Action . . . . . . . . 1 1/B12
  1.2. Background. . . . . . . . . 1 1/B12
  1.3. Study Process . . . . . . . . 5 1/C2

2.0. NATURAL ENVIRONMENT . . . . . . . . 8 1/C5
  2.1. Atmosphere . . . . . . . . 8 1/C5
    2.1.1. Climate . . . . . . . . 8 1/C5
    2.1.2. Air Quality . . . . . . . . 8 1/C5
    2.1.3. Sound . . . . . . . . 10 1/C7
  2.2. Land . . . . . . . . 10 1/C7
    2.2.1. Physiography and Topography . . . . . . . . 10 1/C7
    2.2.2. Geology. . . . . . . . . 11 1/C8
      2.2.2.1. Surficial Geology . . . . . . . . 11 1/C8
      2.2.2.2. Bedrock Geology . . . . . . . . 12 1/C9
    2.2.3. Soil . . . . . . . . 14 1/C11
    2.2.4. Terrestrial Vegetation . . . . . . . . 17 1/D1
      2.2.4.1. Woodlands . . . . . . . . 17 1/D1
      2.2.4.2. Brushlands and Grasslands. . . . . . . . . 18 1/D2
      2.2.4.3. Agricultural Land . . . . . . . . 18 1/D2
      2.2.4.4. Wetlands . . . . . . . . 18 1/D2
      2.2.4.5. Endangered, Threatened, and Rare Plants. . . 19 1/D3
    2.2.5. Wildlife . . . . . . . . 19 1/D3
      2.2.5.1. Amphibians . . . . . . . . 19 1/D3
      2.2.5.2. Reptiles . . . . . . . . 21 1/D5
      2.2.5.3. Birds . . . . . . . . 21 1/D5
      2.2.5.4. Mammals . . . . . . . . 21 1/D5
      2.2.5.5. Endangered and Threatened Animals . . . . . 21 1/D5
  2.3. Water . . . . . . . . 22 1/D6
    2.3.1. Surface Water . . . . . . . . 22 1/D6
      2.3.1.1. Setting and Flow . . . . . . . . 22 1/D6
      2.3.1.2. Uses . . . . . . . . 28 1/D12
      2.3.1.3. Water Quality . . . . . . . . 29 1/D13
    2.3.2. Groundwater . . . . . . . . 33 1/E3
      2.3.2.1. Occurrence . . . . . . . . 33 1/E3
      2.3.2.2. Groundwater Quality . . . . . . . . 34 1/E4
      2.3.2.3. Uses . . . . . . . . 34 1/E4

## TABLE OF CONTENTS (Cont.)

Page

2.3.3. Aquatic Biota . . . . . . . . . . . . . . . . . . 34 1/E4
  2.3.3.1. Upper and Lower Huron River. . . . . . . . 34 1/E4
  2.3.3.2. Middle and Lower Rivers Rouge. . . . . . . 35 1/E5
  2.3.3.3. Detroit River - Lake Erie. . . . . . . . . 35 1/E5
  2.3.3.4. Threatened and Endangered Species . . . . 36 1/E6

3.0. MAN-MADE ENVIRONMENT. . . . . . . . . . . . . . . . . . . . . 37 1/E7
3.1. Demography and Economics . . . . . . . . . . . . . . . . . . 37 1/E7
  3.1.1. Demographic Trends . . . . . . . . . . . . . . . . 37 1/E7
  3.1.2. Population Projections . . . . . . . . . . . . . . 39 1/E10
  3.1.3. Income . . . . . . . . . . . . . . . . . . . . . . 40 1/E11
  3.1.4. Employment . . . . . . . . . . . . . . . . . . . . 42 1/E13
  3.1.5. Public Finance . . . . . . . . . . . . . . . . . . 47 1/F7
3.2. Land Use and Transportation . . . . . . . . . . . . . . . . 54 1/G4
  3.2.1. General Land Use..... . . . . . . . . . . . . . . 54 1/G4
  3.2.2. Existing Land Use . . . . . . . . . . . . . . . . 54 1/G4
  3.2.3. Recreational Land . . . . . . . . . . . . . . . . 56 1/G6
  3.2.4. Housing . . . . . . . . . . . . . . . . . . . . . 56 1/G6
  3.2.5. Transportation . . . . . . . . . . . . . . . . . . 58 1/G8
3.3. Cultural, Historic, and Archaeological Resources . . . . . 58 1/G8
  3.3.1. Prehistory of the Project Area . . . . . . . . . . 58 1/G8
  3.3.2. History of the Project Area . . . . . . . . . . . 60 1/G10
  3.3.3. Sites in the Project Area . . . . . . . . . . . . 61 1/G11
3.4. Wastewater Collection and Treatment Systems . . . . . . . . 64 1/G14
  3.4.1. Walled Lake - Novi . . . . . . . . . . . . . . . . 64 1/G14
  3.4.2. Rouge Valley System . . . . . . . . . . . . . . . 67 2/A8
  3.4.3. Downriver System . . . . . . . . . . . . . . . . . 69 2/A11
  3.4.4. Flat Rock . . . . . . . . . . . . . . . . . . . . 72 2/A14
  3.4.5. Rockwood . . . . . . . . . . . . . . . . . . . . . 73 2/B1
  3.4.6. W.C. - Trenton . . . . . . . . . . . . . . . . . . 74 2/B2
  3.4.7. Trenton . . . . . . . . . . . . . . . . . . . . . 75 2/B3
  3.4.8. Southern Brownstown Township . . . . . . . . . . . 77 2/B5
  3.4.9. Individual Disposal Systems . . . . . . . . . . . 78 2/B6

4.0. FUTURE SITUATION WITHOUT ACTION . . . . . . . . . . . . . . . 80 2/B8

5.0. ALTERNATIVES ANALYSIS . . . . . . . . . . . . . . . . . . . . 83 2/B11
5.1. Introduction . . . . . . . . . . . . . . . . . . . . . . . 83 2/B11
5.2. Component Options . . . . . . . . . . . . . . . . . . . . . 83 2/B11
  5.2.1. Flow and Waste Reduction . . . . . . . . . . . . . 83 2/B11
    5.2.1.1. Infiltration/Inflow Reduction. . . . . . . 83 2/B11
    5.2.1.2. Conservation of Water . . . . . . . . . . 84 2/B12
    5.2.1.3. Diversion of Flows . . . . . . . . . . . . 85 2/B13
    5.2.1.4. Flow Equalization . . . . . . . . . . . . 86 2/B14
    5.2.1.5. Industrial Pretreatment and/or Reuse . . . 86 2/B14
  5.2.2. Collection System . . . . . . . . . . . . . . . . 86 2/B14
  5.2.3. Wastewater Treatment Processes . . . . . . . . . . 88 2/C2
    5.2.3.1. Primary Treatment . . . . . . . . . . . . 89 2/C3
    5.2.3.2. Secondary Treatment . . . . . . . . . . . 89 2/C3

TABLE OF CONTENTS (Cont.)

Page

5.2.3.2.1. Activated Sludge . . . . . . . . 99 2/C3
5.2.3.2.2. Trickling Filter . . . . . . . . 89 2/C3
5.2.3.2.3. Lagoons . . . . . . . . . . . 90 2/C4
5.2.3.2.4. Land Treatment . . . . . . . . 90 2/C4
5.2.3.3. Advanced Wastewater Treatment . . . . . . 91 2/C5
5.2.3.4. Disinfection . . . . . . . . . . . . . . 91 2/C5
5.2.4. Effluent Disposal Methods and Sites . . . . . . . 91 2/C5
5.2.5. Sludge Processing and Disposal . . . . . . . . . 92 2/C6
5.2.5.1. Digestion . . . . . . . . . . . . . . . 92 2/C6
5.2.5.2. Incineration . . . . . . . . . . . . . . 93 2/C7
5.2.5.3. Pyrolysis . . . . . . . . . . . . . . . 93 2/C7
5.2.5.4. Wet Oxidation . . . . . . . . . . . . . 93 2/C7
5.2.5.5. Concentration of Sludge . . . . . . . . . 94 2/C8
5.2.5.6. Conditioning . . . . . . . . . . . . . . 94 2/C8
5.2.5.7. Dewatering and Drying . . . . . . . . . 94 2/C8
5.2.5.8. Land Disposal . . . . . . . . . . . . . 94 2/C8
5.3. System Alternatives . . . . . . . . . . . . . . . . 95 2/C9
5.3.1. Alternative A . . . . . . . . . . . . . . . . . 95 2/C9
5.3.1.1. Alternative A-1 . . . . . . . . . . . . . 96 2/C10
5.3.1.1.1. Components . . . . . . . . . . . 96 2/C10
5.3.1.1.2. Construction and Operation Costs . . . . . . . . . . . . . 100 2/C14
5.3.1.2. Alternative A-2 . . . . . . . . . . . . . 101 2/D1
5.3.1.2.1. Components . . . . . . . . . . . 101 2/D1
5.3.1.2.2. Construction and Operation Costs . . . . . . . . . . . . . 103 2/D3
5.3.2. Alternative B . . . . . . . . . . . . . . . . . 104 2/D4
5.3.2.1. Components . . . . . . . . . . . . . . . 104 2/D4
5.3.2.2. Construction and Operation Costs . . . . . 107 2/D7
5.3.3. Alternative C . . . . . . . . . . . . . . . . . 107 2/D7
5.3.3.1. Components . . . . . . . . . . . . . . . 107 2/D7
5.3.3.2. Construction and Operation Costs . . . . . 110 2/D10
5.3.4. Alternative D . . . . . . . . . . . . . . . . . 110 2/D10
5.3.4.1. Components . . . . . . . . . . . . . . . 110 2/D10
5.3.4.2. Construction and Operation Costs . . . . . 114 2/D14
5.3.5. Alternative E . . . . . . . . . . . . . . . . . 117 2/E3
5.3.5.1. Components . . . . . . . . . . . . . . . 117 2/E3
5.3.5.2. Construction and Operation Costs . . . . . 122 2/E8

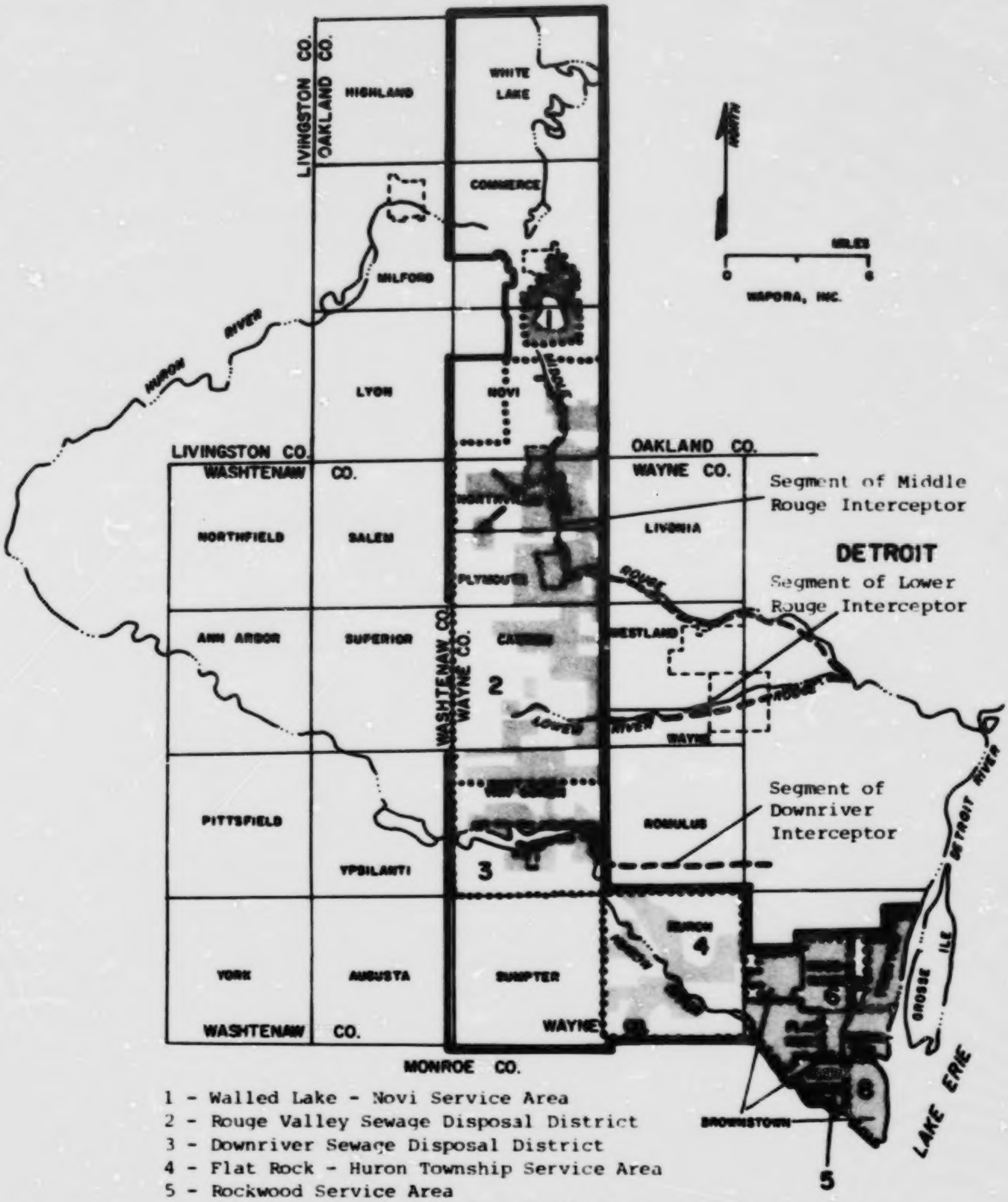
6.0. IMPACTS OF ALTERNATIVES . . . . . . . . . . . . . . . . . 125 2/E11
6.1. Construction Impacts . . . . . . . . . . . . . . . 125 2/E11
6.1.1. Impacts on the Natural and Man-Made Environment . . 125 2/E11
6.1.2. Impacts on Local Public Finance . . . . . . . . . 125 2/E11
6.2. Operation Impacts . . . . . . . . . . . . . . . . . 138 2/G9
6.2.1. Impacts on the Natural and Man-Made Environment . . 138 2/G9
6.2.2. Impacts on Local Public Finance . . . . . . . . . 138 2/G9
6.2.2.1. Alternative A-1 . . . . . . . . . . . . . 145 3/A12
6.2.2.2. Alternative A-2 . . . . . . . . . . . . . 147 3/A14
6.2.2.3. Alternative B . . . . . . . . . . . . . . 148 3/B1
6.2.2.4. Alternative C . . . . . . . . . . . . . . 149 3/B2
6.2.2.5. Alternative D . . . . . . . . . . . . . . 150 3/B3
6.2.2.6. Alternative E . . . . . . . . . . . . . . 150 3/B3

TABLE OF CONTENTS (Concluded)

Page

6.3. Secondary Impacts . . . . . . . . . . . . . . . . . . . . . . . . . . 150 3/B3
6.3.1. Indirect and Induced Growth . . . . . . . . . . . . . 151 3/B4
6.3.2. Impacts of Induced Growth . . . . . . . . . . . . . 152 3/B5
6.4. Minimization of Adverse Impacts . . . . . . . . . . . . . . . . 152 3/B5
6.4.1. Construction Impacts . . . . . . . . . . . . . . . . 152 3/B5
6.4.2. Operation Impacts . . . . . . . . . . . . . . . . . . 156 3/B10
6.4.3. Secondary Impacts . . . . . . . . . . . . . . . . . . 159 3/B13
6.5. Unavoidable Adverse Impacts . . . . . . . . . . . . . . . . . 159 3/B13
6.6. Irretrievable and Irreversible Resource Commitments . . . . 160 3/B14
6.7. Short-term Versus Long-term Impacts . . . . . . . . . . . . 161 3/C1

7.0. CONCLUSIONS AND RECOMMENDATIONS . . . . . . . . . . . . . . . . . 162 3/C2
7.1 Conclusions........................................................ 162 3/C2
7.2 Recommendations ................................................ 163 3/C3
8.0 LITERATURE CITED ............................................... 166 3/C6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WAPORA, INC.
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MILFORD
HURON RIVER
1
LYON
NOVI
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
Segment of Middle Rouge Interceptor
NORTHVILLE
NORTHFIELD
SALEM
LIVONIA
DETROIT
PLYMOUTH
ROUGE
Segment of Lower Rouge Interceptor
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
2
LOWER RIVER
ROUGE
WAYNE
Segment of Downriver Interceptor
PITTSFIELD
VAN BUREN
ROMULUS
YPSILANTI
3
HURON
4
YORK
AUGUSTA
SUMPTER
6
WASHTENAW CO.
WAYNE CO.
GROSSE ILE
DETROIT RIVER
MONROE CO.
8
BROWNSTOWN
LAKE ERIE
5

1 - Walled Lake - Novi Service Area
2 - Rouge Valley Sewage Disposal District
3 - Downriver Sewage Disposal District
4 - Flat Rock - Huron Township Service Area
5 - Rockwood Service Area
6 - Central Brownstown-Woodhaven-Gibraltar Service Area
7 - City of Trenton Service Area
8 - Southern Brownstown Service Area

Figure 7. Sewer service areas in the Huron Valley project area. Areas currently served by sewers are shaded (Giffels/Black & Veatch 1977a; SEMCOG 1976e; Wayne County DPW 1977b).

Table 11. Chemical characteristics of sludge from five wastewater treatment plants in the Huron Valley project area, Michigan (WAPORA 1978). All values are expressed in mg/kg (ppm) dry basis unless otherwise noted; % refers to % of total dry weight.

| WWTP | PARAMETER SAMPLE NO.[1] | COD | AMMONIA as N | NITRATE as N | NITRITE as N | TKN | TOTAL PHOSPHATE as P(%) | TOTAL SOLIDS (%) | TOTAL VOLATILE SOLIDS (%) | CHROMIUM | COPPER | IRON | LEAD | MERCURY | ZINC | MANGANESE | ARSENIC | CADMIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Walled | 1 | 720 | 6.7 | 290 | 2.3 | 43.4 | 7.0 | 20.83 | 10.2 | 155 | 720 | 18,050 | 37 | 2.2 | 1,030 | 955 | 38 | 2 |
| Lake | 2 | 250 | 4.4 | 12 | 6.9 | 20.0 | 3.5 | 36.06 | 9.13 | 80 | 420 | 14,500 | 29 | 1.8 | 670 | 680 | 31 | 2 |
| Flat | 1 | 470 | 6.9 | 23 | 1.7 | 16.1 | 1.4 | 8.72 | 3.13 | 565 | 270 | 49,625 | 54 | 2.2 | 565 | 280 | 9.1 | 1 |
| Rock | 2 | | | | | | | | | | | | | | | | | |
| City of | 1 | 1,150 | 13.1 | 37 | 4.5 | 52.9 | 2.8 | 12.21 | 8.0 | 525 | 435 | 35,050 | 51 | 2.0 | 2,300 | 195 | 1.5 | 3 |
| Trenton | 2 | 1,000 | 12.0 | 35 | 5.1 | 47.4 | 1.7 | 14.17 | 9.66 | 570 | 455 | 33,050 | 43 | 1.5 | 1,940 | 170 | 1.9 | 3 |
| Wayne Co. | 1 | 748 | 8.7 | 44 | 1.7 | 20.8 | 1.5 | 8.02 | 4.83 | 550 | 740 | 36,350 | 27 | 2.2 | 1,640 | 210 | 1.7 | 250 |
| -Trenton | 2 | | | | | | | | | | | | | | | | | |
| Rockwood | 1 | 477 | 6.2 | 45 | 2.7 | 21.6 | 4.1 | 8.59 | 4.42 | 110 | 350 | 58,150 | 83 | 2.8 | 890 | 350 | 1.1 | 2 |
| | 2 | 1,040 | 7.1 | 40 | 2.0 | 13.3 | 1.3 | 8.45 | 3.79 | 135 | 360 | 43,950 | 43 | 3.8 | 835 | 230 | 2.3 | 1 |

---

[1] Sample No. 1 data are from sludge samples collected by WAPORA personnel on 8 and 9 December 1977. Sample No. 2 data are from sludge samples collected by WWTP operators during January 1978. All samples were analyzed by WAPORA.

Effluent limitations established in the permit for 1 May through 31 October are (NA means not applicable):

| EFFLUENT CHARACTERISTIC | DISCHARGE LOAD LIMITATIONS kg/day (lb/day) |  | DISCHARGE CONCENTRATION LIMITATIONS (mg/l) |  |
|---|---|---|---|---|
|  | 30 Day Avg. | Daily Max. | 30 Day Avg. | Daily Max. |
| $BOD_5$ | NA | 53(117) | NA | 10 |
| $NH_3$-N | NA | 11(23) | NA | 2.0 |
| DO | NA | NA | NA | 5.0 |
|  |  | 7 Day Avg. |  | 7 Day Avg. |
| SS | 53(117) | 79(175) | 10 | 15 |
| Fecal Coliform | NA | NA | 200/100 ml | 400/100 ml |

In addition, the plant is to achieve at least an 80% reduction of the influent phosphorus load, with an optimal operational goal to attain an effluent concentration not to exceed 1 mg/l total P. The pH of the discharge is to be within a range of 6.5 to 9.0.

From 1 November through 30 April, the permitted effluent limitations are somewhat less stringent. The daily maximum $BOD_5$ loading limit is increased to 79 kg/day (175 lb/day), with a daily maximum concentration limit of 15 mg/l. The ammonia nitrogen limitation is suspended during this period.

Actual average effluent concentration quality for the first nine months of 1977, as reported in the plant's monthly operating reports, was: 6.5 mg/l $BOD_5$; 1.4 mg/l $NH_3$-N (5 month average); 6.6 mg/l DO; 4.1 mg/l SS; 1.0 mg/l total P; 41/100 ml fecal coliform; and a pH range from 6.8 to 8. This is equivalent to an average daily load of approximately 55 pounds of $BOD_5$, 35 pounds of SS, 12 pounds of $NH_3$-N, and more than 8 pounds of total P. Both the concentrations and loading values are well within the permit limitations.

### 3.4.2. Rouge Valley Sewage Disposal District

Communities within the north-central part of the project area with local sewer systems are served by the Rouge Valley Sewage Disposal District (RVSDD, Figure 7). The estimated population and land area served by these systems is shown in Table 12. Because the land area figures are more recent than the service area population estimates, larger areas may be reflected than actually were served during 1974. All sewer systems are designed for sanitary flows (separated sewers), with the exceptions of small areas in southeastern Plymouth Township which utilize combined sewers. The total area of 61,250 acres in these communities had an estimated total 1974 population of 85,070. Forty-six percent (23,310 acres) of the land area with an estimated total 1974 population of 15,770 (18.5%), remains unsewered. Residents within unsewered areas rely on private on-site septic disposal systems.

Table 12. Project area communities served by the Rouge Valley Sewage Disposal District.

| | Community Populations Served[1] | | | Community Land Areas Served[2] | | |
|---|---|---|---|---|---|---|
| Community | 1974 Est. Population | 1974 Est. Sewered Population | Total Area (Acres) | Area on Separate Sewers (Acres) | Area on Combined Sewers (Acres) | Area Without Sewers (Acres) |
| Novi (Southern 48%) | 15,300 | 5,700 | 9,730 | 3,840 | -- | 5,890 |
| Northville | 5,670 | 5,670 | 1,340 | 1,130 | -- | 210 |
| Northville Township | 12,200[3] | 11,555[3] | 10,690 | 6,400 | -- | 4,290 |
| Plymouth | 11,400 | 11,400 | 1,410 | 1,410 | -- | -- |
| Plymouth Township | 18,600 | 18,600 | 10,240 | 3,710 | 130 | 6,400 |
| Canton Township | 21,900 | 15,075 | 23,040 | 11,520 | -- | 11,520 |
| Van Buren Township (Northern 21%) | NA[4] | 1,300 | 4,800 | 4,800 | -- | -- |
| Totals | 85,070[3,5] | 69,300[3] | 61,250 | 32,810 | 130 | 28,310 |

---

[1] From: Board of Wayne County Road Commissioners 1976.

[2] From: Giffels/Black & Veatch 1977c.

[3] This does not include up to 5000 residents of various public institutions in Northville Township served by sewers.

[4] NA: Population breakdown not available for this section of township.

[5] Excludes population of northern 21% of Van Buren Township.

The RVSDD is managed by the Wayne County DPW. Each of the member local sewer systems has contracted for capacity in the interceptors which convey wastewater from the communities' collection system to the Detroit WWTP (Table 12). The flows to the Detroit system from the entire RVSDD represent the largest contribution from any of the eleven Detroit and suburban districts served (Giffels/Black & Veatch 1977c).

The RVSDD is divided into two major subdistricts, the Middle Rouge Subdistrict and the Lower Rouge Subdistrict. The southeastern part of Novi, Northville, Northville Township, Plymouth, Plymouth Township, and Canton Township are in the Middle Rouge Subdistrict, while the rest of Canton Township and the northern part of Van Buren Township are in the Lower Rouge Subdistrict. Interceptor sewers conveying wastewater from each of these subdistricts to the east parallel the Middle and Lower Rivers Rouge, respectively (Figure 7). The Middle Rouge and Lower Rouge interceptors join to form the Rouge Valley Interceptor at the confluence of the Lower River Rouge and River Rouge. The Rouge Valley Interceptor connects to the Detroit system.

The maximum sewage flow being generated by each community during 1977 as estimated by the Wayne County DPW, in the absence of metered flow data, is presented in Table 13. Average contributions of domestic and industrial sanitary flow are in Table 14. These average values were based on three months of flow measurement in 1973. The table, therefore, only reveals the relative contribution by each source with much accuracy. More recent data is not avaiable from the Wayne County DPW.

Wayne County has a contract with the Detroit Water and Sewerage Department to accept a total flow from the Rouge Valley system of 324.5 cubic feet per second (approximately 210 mgd). Based on the estimated dry weather flows for the entire District, the Wayne County DPW determined that the system as a whole is at 77.2% of its design capacity. Some communities (primarily in the western section of the District) are exceeding their purchased capacity (Table 13), while others are utilizing less than their allocation. Infiltration inflow throughout the system, and combined sewer flow in the eastern parts of the District cause the Rouge Valley Interceptor to be overloaded during extended wet weather periods. This results in overflows of untreated wastewater into the Middle and Lower Rivers Rouge, and the River Rouge to the east of the project area.

Facility planning to determine the most cost-effective approach to solving the combined sewer overflow problem in the RVSDD had not been initiated as of 1 August 1978. No reliable information, therefore, is available on which to base assumptions about the availability of future capacity in the Middle and Lower Rouge Interceptors. The purchased capacity values shown in the first column of Table 13 are not equivalent to the actual physical capacity of the interceptor (Section 5.0).

### 3.4.3. Downriver Sewage Disposal District

The sewered area in central and southern Van Buren Township and the City of Belleville (Figure 7) is served by the Downriver Sanitary District. The estimated 1974 service area population in this sewered section of the Township is 6,200. Belleville is entirely sewered; therefore, its total estimated 1974 population of 3,480 is the service area population.

Table 13. Estimated utilization of Rouge Valley Interceptor capacity by communities in the project area (Wayne County DPW 1977a).

| | Purchased Capacity (cfs) | Maximum Sewage Flow[1] (cfs) | Combined Sewage Flow (cfs) | % Purchased Flow Used (Maximum + Combined) | Comment |
|---|---|---|---|---|---|
| Novi | 4.00 | 3.08[2] | - | 77.0 | Below Capacity |
| Northville | 3.60[3] | 4.47 | - | 124.2 | Exceeding Capacity |
| Northville Twp. | 8.01[4] | 7.37 | - | 92.0 | At Capacity |
| Plymouth | 4.80 | 7.15 | - | 149.0 | Exceeding Capacity |
| Plymouth Twp. | 9.60 | 14.26 | 0.07 | 149.3 | Exceeding Capacity |
| Canton Twp. | 14.37[5] | 13.31 | - | 92.6 | At Capacity |
| Van Buren Twp. | 3.20 | 0.57 | - | 17.8 | Significantly Below Capacity |
| TOTAL | 47.58 | 50.21 | 0.07 | | |

---

[1] System flows are not metered; average flows have been estimated by the Wayne County DPW based on water consumption records; peak flows were then estimated based on methodology in Water Pollution Control Federation (1970).

[2] Novi utilizes flow-equalization basins to reduce peak flows.

[3] Northville is presently leasing an additional 4.0 cfs in the Middle Rouge Interceptor from Livonia.

[4] Institutions within Northville Township own 5.41 cfs of the 8.01 cfs.

[5] 7.47 cfs of the capacity is in the Middle Rouge Interceptor and 6.9 cfs in the Lower Rouge Interceptor.

Table 14. Average domestic and industrial flow contribution in 1973 from project area communities, excluding the Walled Lake-Novi system (Wayne County Board of Road Commissioners 1976).

| | Domestic Wastewater (mgd) | Industrial Wastewater (mgd) | Total Flow (mgd) |
|---|---|---|---|
| Novi | 0.597 | 0.140 | 0.737 |
| Northville | 0.447 | 0.252 | 0.699 |
| Northville Twp. | 0.285 | 0.948 | 1.233 |
| Plymouth | 0.496 | 0.630 | 1.126 |
| Plymouth Twp. | 0.877 | 1.490 | 2.367 |
| Canton Twp. | 1.300 | 0.027 | 1.327 |
| Van Buren Twp.[1] | 0.364 | 0.296 | 0.660 |
| Belleville | 0.288 | 0.038 | 0.326 |
| Huron Twp. | 0.181 | 0.011 | 0.192 |
| Flat Rock | 0.285 | 1.000 | 1.285 |
| Rockwood | 0.175 | 0.033 | 0.208 |
| S. Rockwood | 0.047 | 0.022 | 0.069 |
| Gibraltar | 0.230 | 0.142 | 0.372 |
| Brownstown Twp. (Central) | 0.307 | 0.057 | 0.364 |
| Trenton | 1.762 | 2.244 | 4.006 |
| Woodhaven | 0.526 | 0.115 | 0.641 |
| Brownstown Twp. (South) | 0.090 | 0.003 | 0.093 |

---

[1] Breakdown of relative contributions of flow to the RVSDD and to the Downriver System are not available.

The western end of the Wayne County-Downriver Interceptor enters Van Buren Township at the Wabash and Hannan Road intersection. It follows East Huron River Drive and the Norfolk and Western railroad tracks southwest to near downtown Belleville. All sanitary sewers south of Belleville Lake discharge to this interceptor. A local trunk sewer also conveys flows from north of Belleville Lake to the Wayne County-Downriver Interceptor. This interceptor conveys the flows from east along Eureka Road through Romulus, Taylor, and Southgate to the Wayne County Wyandotte WWTP.

The City of Belleville and Van Buren Township have contract capacities of 2.8 cfs and 5.2 cfs, respectively, in the Downriver Interceptor. Peak flows generated in the Belleville service area averaged 2.03 cfs or 72.5% of contracted capacity while flow from the township service area averaged 3.87 cfs, or 73% of contract capacity. Average domestic and industrial flows for Belleville and Van Buren Township (includes northern section which is in the RVSDD) are shown in Table 14 (1973 estimates).

### 3.4.4. Flat Rock Wastewater Control System

The entire City of Flat Rock and sections of Huron Township are served by sanitary sewers. Sewered areas within Huron Township include the New Boston area; an area in the southwestern section of the Township near Interstate 275; and the east-central part of the Township (Figure 7). The estimated total 1974 population of 5,850 in Flat Rock and an estimated 2,023 (25% of the total 1974 estimated population of 8,050 in Huron Township) result in a total 1974 service-area population of nearly 7,900.

Interceptors from New Boston and the southwestern section of the Township intersect near the Huron River in the Willow Metropark. One main interceptor conveys flows from these areas plus flows from the east-central service area to the Flat Rock WWTP.

The Flat Rock WWTP, located near the southeast boundary of Flat Rock, became operational in 1939 and was expanded in 1964. Secondary treatment and phosphorus control were added during 1970. Present plant design is for treatment of 1.0 mgd of sanitary sewage generated in the Flat Rock-Huron Township sewer service area. Flows generated during 1977 averaged 2.7 mgd. This severe overloading has resulted in the bypass of raw wastewater to the Huron River.

The plant is operated by the Wayne County DPW. The age of the plant and its overloaded capacity contribute to operational problems. The concrete in the primary treatment tanks is deteriorating and mechanical equipment is old and corroded. The exterior walls of the trickling filter (which provides the secondary treatment) are cracking and deteriorating. A portable effluent pump has been installed to bypass sewage flows in excess of operational capacity. Influent wastewater characteristics are: 150 mg/l $BOD_5$; 220 mg/l SS; total phosphorus of 6 mg/l; and a pH of 6.9 (Hubbell, Roth, & Clark, Inc. 1976). The WWTP occupies 0.48 acres, and there is no undeveloped land adjacent to the plant site for expansion.

Sludge generated in the treatment process is trucked to the Wyandotte WWTP for incineration. The composition of this sludge is presented in Table 11. Average annual sludge production is estimated to be 270 tons on a dry weight basis.

The discharge from the WWTP to the Huron River is regulated by the Michigan WRC through NPDES Permit No. MI 0024323. The effluent limitations imposed by the permit are:

| Effluent Characteristic | Discharge Concentration (mg/l) | |
|---|---|---|
| | 30 Day Avg. | 7 Day Avg. |
| $BOD_5$ | 15 | 25 |
| SS | 20 | 30 |
| Fecal Coliform | 200/100 ml | 400/100 ml |

(No load limitations have been established at this time.) In addition, the plant is to achieve at least an 80% reduction of the influent total P load, with an optimal operational goal to attain an effluent concentration not to exceed 1.0 mg/l P. The pH of the discharge is to be within a range of 6.5 to 9.0.

During the first ten months of 1977 the average effluent concentrations reported in the plant's monthly operational report were 47 mg/l $BOD_5$, 44 mg/l SS, 79/100 ml fecal coliform, and 1.6 mg/l total P. This indicates the plant is in violation of its permit limitations. Effluent monitoring data, however, do not reflect bypassed sewage; therefore, the report data do not reveal final effluent conditions. It is estimated that the total daily loads of primary pollutants from this plant are: 2,500 pounds $BOD_5$, 3,500 pounds SS, and 100 pounds total phosphorus.

A sewer connection ban was ordered by the Michigan WRC in December 1977 in an attempt to preclude additional inputs to the overloaded system. This ban subsequently was rescinded. The City of Flat Rock, however, has enforced its own ban on new hook-ups because of a surcharging problem which has caused basement flooding in the City.

### 3.4.5. Rockwood Wastewater Control System

Rockwood has a local sanitary sewer system which serves an estimated population of 3,011 (93% of a total estimated population of 3,250 in the city in 1974). South Rockwood, across the Huron River from Rockwood, is sewered, with an estimated 1974 service area population of 1,410 (100% of the population of the City). Flows from South Rockwood enter the Rockwood system and the resultant total flow is conveyed to the Rockwood WWTP.

The Rockwood WWTP is located adjacent to the Huron River immediately southeast of Rockwood. The plant was built in 1939 as a primary treatment facility, and was expanded in 1963 and again in 1971 when secondary treatment and phosphorus removal capabilities were added. The service area population of about 4,500 in Rockwood and South Rockwood presently contributes about 0.37 mgd to the plant, which has a design capacity of 1.0 mgd. Average influent wastewater characteristics are: 150 mg/l $BOD_5$; 180 mg/l SS; 35 mg/l total P; and a pH of 6.9 (Hubbell, Roth & Clark, Inc. 1976).

The treatment plant is operated by the Wayne County DPW. The newer secondary treatment facilities, consisting of plastic media filters, secondary clarifiers, and chemical feeding equipment are in good condition. Chlorination is provided for disinfection of the effluent.

Sludge generated by the treatment process is estimated to average 230 tons per year on a dry weight basis. Chemical characteristics of the sludge are shown in Table 11. The sludge is trucked to the Wayne County-Wyandotte WWTP for incineration.

The plant site covers 1.0 acre. There is little land available adjacent to the site for expansion. Land to the north is low and floods occasionally; a railroad right-of-way borders the property on the east; and the Huron River borders the remainder of the site.

The discharge from the WWTP to the Huron River is regulated by NPDES Permit No. MI 0021181, issued by the Michigan WRC. The effluent limitations imposed by the permit are:

| EFFLUENT CHARACTERISTIC | DISCHARGE LOAD LIMITATIONS kg/day (lb/day) | | DISCHARGE CONCENTRATION LIMITATIONS (mg/l) | |
|---|---|---|---|---|
| | 30 Day Avg. | 7 Day Avg. | 30 Day Avg. | 7 Day Avg. |
| $BOD_5$ | 57(125) | 85(187) | 20 | 30 |
| SS | 57(125) | 85(187) | 20 | 30 |
| Fecal Coliform | NA | NA | 200/100 ml | 400/100 ml |

In addition, the plant is to achieve an 80% reduction of the influent phosphorus load, with an optimum operational goal to attain an effluent concentration not to exceed 1 mg/l. The pH of the discharge also must be between 6.5 and 9.0.

The monthly operational reports from the plant for the first ten months of 1977 show the actual discharge to have an average concentration of 28 mg/l $BOD_5$; 38 mg/l SS; and 60/100 ml fecal coliform; 10.6 mg/l total phosphorus, or 53% removal; and a pH range of 5.4 to 7.5. The equivalent average daily loadings to the Huron River are: 90 pounds $BOD_5$; 120 pounds SS; and 35 pounds total P. The average discharge is thus in violation of the permit conditions.

### 3.4.6. Wayne County-Trenton (W.C.-Trenton) Wastewater Control System

This system consists of local collection sewers in central Brownstown Township, Woodhaven, and Gibraltar which are connected to the W.C.-Trenton WWTP on Jefferson Avenue in Trenton by interceptor sewers. The estimated 1974 service area populations for these communities are: central Brownstown, 5,520; Woodhaven, 6,250; Gibraltar, 4,200; a total of approximately 16,000. A 42-inch diameter trunk sewer along Van Horn Road conveys sanitary sewage flows from west-central Brownstown Township and Woodhaven eastward to the WWTP. Flows from the Brownstown Township area south of Woodhaven are conveyed via a trunk sewer along Allen Road to the Van Horn Interceptor. Sanitary sewage flows from Gibraltar are conveyed north along River Road to the WWTP.

The W.C.-Trenton WWTP began operation in 1939. It presently provides primary treatment for sewage flows generated in the Central Brownstown-Woodhaven-Gibraltar sewer service area. Design flow for the plant is 2.4 mgd, and the 1977 average flow was 2.1 mgd. Because of the high infiltration/inflow (I/I) experienced in the collection system, the plant has received peak wet weather flows which greatly exceed the design capacity. Under such conditions, the plant frequently becomes flooded and sewage flows receive little treatment before discharge to the Detroit River.

The plant is operated by the Wayne County DPW. Although the facilities receive good maintenance, their age causes significant operational problems. Influent wastewater concentrations during dry weather flows average 150 mg/l $BOD_5$; 180 mg/l SS; 6.2 mg/l total P; and pH of 6.8 (Hubbell, Roth & Clark, Inc. 1976). The treatment process generates an estimated average of 440 tons of sludge per year (Table 11). The plant occupies 4.1 acres.

Discharge from the WWTP is to the Elizabeth Park Canal, tributary to the Trenton Channel of the Detroit River. This discharge is regulated by NPDES Permit No. MI 0024317. Effluent limitations required by the permit are:

| EFFLUENT CHARACTERISTIC | DISCHARGE LOAD LIMITATIONS kg/day (lb/day) | | DISCHARGE CONCENTRATION LIMITATIONS (mg/l) | |
|---|---|---|---|---|
| | 30 Day Avg. | 7 Day Avg. | 30 Day Avg. | 7 Day Avg. |
| $BOD_5$ | 398(876) | 597(1,314) | 30 | 45 |
| SS | 398(876) | 597(1,314) | 40 | 45 |
| Fecal Coliform | NA | NA | 200/100 ml | 400/100 ml |
| Oil and Grease | NA | NA | NA | Daily Max. 10 |

In addition, the plant must achieve an 80% reduction of the influent phosphorus load, with a goal of obtaining a 1.0 mg/l total P effluent concentration through optimal plant operation. The pH of the discharge must be within the range of 6.5 to 9.0.

Discharge monitoring data from plant operational reports for the first six months of 1977 indicated actual average effluent concentrations of 62 mg/l $BOD_5$, 55 mg/l SS, 94/100 ml fecal coliform, and 4.3 mg/l phosphorus or 31% removal. The equivalent average daily loadings are estimated to be: 1,090 pounds $BOD_5$; 965 pounds SS; and 75 pounds total P. These values indicate the plant was not meeting the discharge standards.

### 3.4.7. Trenton Wastewater Control System

Originally, Trenton conveyed its combined wastewater to the W.C.-Trenton WWTP. In 1962, however, the city built its own treatment plant and began a program of removing storm water from its collection system. In 1969, the remaining combined sewers in the older section of Trenton were separated; however, during heavy rains, some stormwater problems continued to occur. A new pumping station was installed in 1970 along with a 12.5 million gallon retention basin to store excess storm water in the system for later treatment. The service area population is approximately 25,500.

The Trenton WWTP is located in southeastern Trenton near the Detroit River. The plant was upgraded in 1970 to provide secondary treatment with phosphorus removal. The present design capacity is 5.5 mgd, and the average flow in 1977 was 5.6 mgd--slightly in excess of design capacity.

The plant is operated by the City of Trenton. The older part of the plant is beginning to show signs of aging, especially the mechanical equipment. Influent wastewater characteristics are: 230 mg/l $BOD_5$; 220 mg/l SS; 6.9 mg/l total P; and a pH of 7.2 (Hubbell, Roth & Clark, Inc. 1976). There is a large amount of industrial flow (Table 14) to the plant which contributes variable strength slugs of poor quality wastewater. Wastewater treatment includes grit removal, primary treatment in settling basins, an activated sludge secondary treatment process, and chlorination for disinfection. Pickle liquor is added to the aerated grit chamber to precipitate phosphorus in the primary as well as final clarifiers. Tube settlers have been installed to assist in the final settling of lighter floc. However, the inadequate capacity of the primary treatment system allows high levels of suspended solids to pass through into the secondary system. This causes blockage of the tube settlers. Two additional primary tanks are needed to eliminate this problem.

Sludge generated in the treatment process is subjected to gravity thickening and vacuum filtration prior to incineration on site. Sludge characteristics are shown in Table 11. Net sludge production is estimated to average about 2,000 tons per year. A backup sludge incineration unit is needed to provide relief and backup for the existing system.

Land area of the treatment plant site is nearly 10 acres, including about 4 acres leased from Detroit Edison for the retention basin. Only limited room exists for expansion, as the site is completely surrounded by streets, railroad tracks, power lines, and the retention basin.

The plant discharges effluent to the Elizabeth Park Canal, tributary to the Trenton Channel of the Detroit River. This discharge is regulated by NPDES Permit No. MI 0021164 issued by the Michigan WRC. The applicable effluent limitations are:

| EFFLUENT CHARACTERISTIC | DISCHARGE LOAD LIMITATIONS kg/day (lb/day) | | DISCHARGE CONCENTRATION LIMITATIONS (mg/l) | |
|---|---|---|---|---|
| | 30 Day Avg. | 7 Day Avg. | 30 Day Avg. | 7 Day Avg. |
| $BOD_5$ | 853(1,876) | 1,280(2,814) | 30 | 45 |
| SS | 853(1,876) | 1,280(2,814) | 30 | 45 |
| Fecal Coliform | NA | NA | 200/100 ml | 400/100 ml |
| | Daily Max. | | Daily Max. | |
| Oil & Grease | NA | NA | 15 | NA |
| Phenol | 2.3(5.0) | NA | NA | NA |

In addition, the plant is to attain at least an 80% reduction in the amount of influent phosphorus and, insofar as optimum operations of the facilities will attain such a level, shall contain not more than 1 mg/l of total phosphorus. The pH of the discharge also must be within a range of 6.5 to 9.0.

The actual effluent characteristics during the first nine months of 1977 as reported in the plant's monthly reports were: 11.7 mg/l $BOD_5$; 20.8 mg/l SS; 135/100 ml fecal coliform; 2.12 mg/l total P or 81% removal; and a pH range of 6.6 to 8.4. The estimated equivalent average daily loadings to the receiving water are 550 pounds $BOD_5$; 975 pounds SS; and 100 pounds total P. Thus, the average treatment conditions provide an effluent quality which exceeds the level of treatment required by the permit.

### 3.4.8. Southern Brownstown Township Wastewater Control System

The south part of Brownstown Township (sections 11, 12, 13, 14, 23, and 24) is predominantly sewered, serving an estimated 1,800 of its nearly 2,800 residents. An interceptor sewer parallels Jefferson Avenue in Section 13.

Brownstown Township entered into an agreement in 1966 with the Wayne County Road Commission to construct the existing wastewater stabilization lagoons for treatment of sanitary sewage flows generated in the southern Brownstown area. The lagoons consist of two ponds totaling about 18 to 20 acres. The ponds are situated on a 54-acre site owned by the Township. Average daily flow to the lagoons is estimated to be 0.18 million gallons.

The lagoons are operated by the Brownstown Township Water and Sanitation Department. Discharge from the lagoons to Morrison Drain (tributary to Silver Creek and the Huron River) is intermittent and is regulated by NPDES Permit No. MI 0022471. Effluent limitations imposed by the permit for the period 1 May through 31 October are:

| EFFLUENT CHARACTERISTIC | DISCHARGE CONCENTRATION LIMITATIONS (mg/l) | |
|---|---|---|
| | 30 Day Avg. | Daily Max. |
| $BOD_5$ | NA | 10 |
| $NH_3$-N | NA | 2.0 |
| DO | NA | 5.0 |
| | | 7 Day Avg. |
| SS | 10 | 15 |
| Fecal Coliform | 200/100 ml | 400/100 ml |

(Load limitations have not been established.) Additionally, the permit requires that at least an 80% reduction of influent phosphorus must be achieved, with a goal of attaining 1.0 mg/l where operationally possible. The pH of the discharge must be in the range of 6.5 to 9.0.

During the 1 November to 30 April period, somewhat less stringent limitations are required: the $BOD_5$ and SS daily maximum concentrations are increased to 15 mg/l and 22 mg/l, respectively; the $NH_3$-N limitation is suspended; and a DO minimum concentration limitation of 5.0 mg/l is imposed.

Discharge quality as reported on monthly monitoring forms for April, May, and October 1977 (the only 3 months of 1977 for which discharges were reported), averaged 12.9 mg/l $BOD_5$; 26.1 mg/l SS; 27/100 ml fecal coliform; and a pH of 8.1. Total reported effluent flow during these three months averaged 0.7 mgd for the days in which discharges were reported (only about one-half of the days of each of these months). Ammonia and phosphorus levels were not monitored. The levels of BOD and SS discharged during April and May 1977 were subject to interim effluent limitations (effective until 30 June 1977) requiring a 30 mg/l 30-day average concentration, which was met. The lagoons are hydraulically overloaded, causing short retention time. The potential exists for the treatment system to violate its effluent limitations.

### 3.4.9. Individual Disposal Systems

There is widespread dependence on individual, on-lot septic disposal systems in much of the project area from Sumpter Township north to White Lake Township. Of primary concern are the more densely developed areas of White Lake, Commerce, and Sumpter Townships, which are entirely unsewered, and the unsewered portions of Novi and Northville Township.

The installation of septic tank disposal systems in White Lake and Commerce Townships, and in Novi is regulated by the Oakland County Department of Health pursuant to the Oakland County Sanitary Code. Many of the septic systems in this area, however, were developed prior to the adoption of the Code and do not presently incorporate provisions designed to ensure proper operation and to protect groundwaters. In White Lake Township, much of the early lakeside development was for cottage-type occupancy on small-sized lots. Many now are occupied on a full-time basis, causing the original on-site sewage disposal systems to become overloaded or to fail (By letter, Mr. R. A. Long, Oakland County Division of Public Health, 14 November 1977). Additionally, many of the on-site septic systems were located in close proximity to lakes, in areas of high groundwater levels, or in areas with organic, dense clay, or sandy soils. Such soils frequently are not suitable to absorb contaminants in septic tank effluent or will not allow for acceptable rates of infiltration and percolation. Of the 292 applications for new septic system permits in White Lake Township during 1977, 29 (10%) were denied because of unsuitable soil conditions (By letter, Mr. R. A. Long, Oakland County Division of Public Health, 24 January 1978).

Locations within the Township of specific concern are the areas surrounding White Lake, Pontiac Lake, Lake Neva, the Lakewood Village Subdivision, and the area in the southeastern section of the Township where many densely populated lakeside developments exist (By letter, Mr. R. A. Long Oakland Division of Public Health, 14 November 1977).

Conditions are much the same in Commerce Township and Novi where septic systems are being utilized although problem areas are not as well documented. The highly developed Union Lake Road area in Commerce Township has been noted as being a problem area (By telephone, Mr. William Carlson, Oakland County Division of Public Health, 14 November 1977). No detailed groundwater quality studies or septic system monitoring data exist to document the extent of the problem.

The Wayne County Department of Health, which administers a septic system permit program, conducted field investigations in Sumpter Township during 1973 and documented groundwater contamination problems resulting from the use of septic disposal systems (Wayne County Department of Health 1974). Many private drinking water supplies from shallow wells throughout the Township were found to be mildly contaminated, and surface water drains were found to be receiving heavily polluted runoff from ponded septic effluent because septic systems were malfunctioning. Because of such conditions, which have been judged to present public health hazards to the residents of Sumpter Township, a facilities plan has been completed which proposes a sewer system for the Township which would discharge collected wastewater to the proposed Huron Valley Interceptor.

While problem areas for individual disposal systems have been documented by the local health departments, no comprehensive land suitability studies have been undertaken. It is unclear, therefore, as to how much new development could be accomodated by septic systems in currently undeveloped sections of the project area compared to how much would require sewers.

## 4.0. FUTURE SITUATION WITHOUT ACTION

The alternative of "no action" essentially would entail continued operation of the six project area WWTPs without any significant expansion, upgrading, or replacement during the current design period (to 1995). The effect in some cases would be to limit growth and to exacerbate environmental problems. Because certain aspects of this alternative would violate State and Federal laws, it is not a feasible solution.

The Walled Lake and City of Trenton WWTPs may be capable of maintaining adequate treatment levels through 1995 without significant modification unless service area population grows at rates larger than projected. The other four WWTPs would continue to discharge effluent which does not meet State standards. Pollutant loadings from discharge of inadequately treated wastewater at the Flat Rock, Rockwood, and Wayne County-Trenton WWTPs, and the Brownstown Lagoons would continue to increase, especially in the Lower Huron River. The Detroit River and the western basin of Lake Erie also will continue to be degraded, but the effects would be less discernible.

Raw sewage which would be discharged by overloaded treatment facilities would contain high levels of BOD, solids, and other pollutants, including potential discharges of heavy metals and toxic substances. Increased algal production probably would result from the nutrients in effluents from these WWTPs. Dissolved oxygen levels would be lowered by high BOD loads and by decomposition of aquatic vegetation. Elevated levels of suspended solids would increase turbidity and siltation. The benthic habitat would suffer and it is likely that only the most pollution-tolerant forms would survive. Fish populations increasingly would become characterized by "rough fish".

Bacterial levels in the Lower Huron River may increase sharply as the volume of untreated or partially-treated wastewater increases. This could result in restrictions on body-contact recreation in many areas.

Direct adverse impacts on air quality would be minimal. It is possible that as the four WWTPs increasingly become overloaded, odors could become a persistent problem. In addition, odors may be generated in sections of the Lower Huron River as progressively larger amounts of raw sewage are discharged and as plants die and decompose.

Significant impacts are likely to occur in wetlands as pollutant loadings increase throughout the project area. The most severe stress would be placed on swamps, bogs, and marshes adjacent to the Lower Huron River downstream from the Flat Rock WWTP and on wetlands along the western shore of Lake Erie. Wetland plants eventually may be restricted to only the most pollution-tolerant forms. The degraded habitat may not be suitable to support the current waterfowl and other wildlife usage. Algal blooms would be common.

Continuing deterioration of area watercourses and Lake Erie would have substantial adverse effects on the aesthetics of the project area. Visual impacts along the Lower Huron River and Lake Erie could include algal mats, dead fish, and debris. The aesthetic quality of riverside parks would decline.

Because the four WWTPs would be unable to meet conditions of their respective NPDES permits to discharge (Section 3.5) and because stream water quality standards would be violated, legal action would be taken against the operators of these systems. This would include enforcement of sewer connection bans in service areas where the WWTP is overloaded or otherwise failing to meet effluent requirements. (Such a ban was temporarily implemented by the Michigan WRC in early 1978 for the Flat Rock-Huron Township, Wayne County-Trenton, Rockwood-South Rockwood, and southern Brownstown Township service areas.) Legal proceedings resulting in court orders to upgrade and expand the WWTPs also would likely be forthcoming. The potential exists that fines could be levied against the communities.

The lack of adequate new capacity at public wastewater treatment facilities would require increased use of on-site disposal systems. Many sections of the project area have soils which generally are unsuitable for such systems, especially in Sumpter Township. Increasing use of on-site disposal systems may result in groundwater contamination and degradation of surface water. The utilization of wells may be curtailed in some places, forcing importation of potable water.

Growth patterns could be influenced by the lack of sufficient treatment capacity in the project area. Costs for new housing could rise substantially to cover the expense of septic tank installation. Sewer-connection bans and/or dependence on private septic systems would limit the density of residential development. The dispersed pattern of population distribution could contribute to preservation of the rural and semi-rural character of a large segment of the project area. It also is possible that "leap-frog" growth will occur. Locales with soil suitable for disposal of wastes from on-site systems will attract new development, while areas with unsuitable soils will be bypassed. On a larger scale, development may shift to locations outside the project area where public sewerage facilities are available. This substantially could limit industrial and commercial expansion in the project area.

The combination of depressed economic development and increased costs of lands suitable for development would tend to exclude low-income families. The trend could be toward low-density residential communities whose residents work outside the area.

A dispersed pattern of area development would place an emphasis on the use of the automobile for transportation. Workers would be required to commute over longer distances and fuel consumption would increase. Relative future traffic volume, however, may be decreased when compared to the levels likely to result from more intensive development. Low-density housing is not likely to encourage expansion of existing roads.

The lower growth rate associated with the "no action" alternative could aid in the preservation of cultural, historical, and archaeological resources. Limited development would be less likely to result in destruction of significant cultural and historic sites. A rural character in the project area would enhance the setting of historic buildings and districts. Archaeological resources would be subject to less disturbance by new construction. Conversely, discoveries owing to excavations for developments would be limited.

The limited future growth which is likely to result from the "no action" alternative probably would not create a need for substantially increased community services. In those areas where new development occurs in a widely-scattered manner, it may be difficult to provide a high level of service because of limited personnel. For example, police would be required to cover larger areas per officer if dwellings and businesses were spread out than if developments were more concentrated.

Redistribution of population and lack of growth may reduce the need for existing schools in many parts of the project area. Communities whose future plans incorporate a dependence on new residents may be unable to meet financial obligations with a stabilizing or declining population.

Recreational resource use also may be affected. As the environment deteriorates in areas subject to increasing pollution, the demand for suitable recreation areas will shift to relatively unaffected locations. In the project area and in neighboring communities, many governmental units may be unable to provide sufficient natural recreation areas to replace those degraded by pollution.

Failure to act to remedy wastewater management problems in the project area may have significant adverse impacts on future public finances. Growth is likely to be limited and some communities may experience out-migration of residents as the sewer service problem worsens. The local tax base could decrease if population and industry leave the project area. The per capita tax burden may become very heavy in some communities. It is possible that land values will not rise as rapidly as those in adjacent areas, and some land may decrease in value. This would add to the tax problem, especially in communities such as Canton Township and the City of Woodhaven which depend heavily on property taxes as a source of general revenue (Section 3.1.3.).

# 5.0. ALTERNATIVES ANALYSIS

## 5.1. Introduction

The development of alternative wastewater management systems to serve the Huron Valley project area began with the selection of potentially functional components. The following five components were considered in the development of alternatives:

- Flow and Waste Reduction
- Collection System
- Wastewater Treatment Processes and Sites
- Effluent Disposal Methods and Sites
- Sludge Processing and Disposal.

Several optional technologies or programs are available for each component (Section 5.2.). The options selected for one component, however, must be compatible with options considered for other components; i.e., there are functional dependencies among the various component options. For example, reduction of wastewater flow is highly compatible with any of the various collection system options, but a regional interceptor is not compatible with a wastewater treatment option which includes upgrading and expanding existing treatment plants. Thus, consideration of one component option may preclude or necessitate consideration of other options in another component.

Through the screening of options for each of the five components, compatible options were combined into conceptual system alternatives. Those which exhibited reasonable cost; technical feasibility; acceptable environmental, socioeconomic, and energy impacts; and social implementability were brought forward for more detailed engineering and costing. Alternatives previously selected for detailed costing in the HVWWCS Facility Plan automatically were analyzed further. Five system alternatives and a variation of one alternative are discussed in detail herein.

## 5.2. Component Options

### 5.2.1. Flow and Waste Reduction

Options considered under this component include:

- Infiltration/Inflow Reduction
- Conservation of Water
- Diversion of Wastewater
- Flow Equalization
- Industrial Pretreatment and/or Reuse.

#### 5.2.1.1. Infiltration/Inflow Reduction

Wayne County, the HVWWCS project sponsoring agency, prepared an analysis of infiltration/inflow (I/I) for the Huron Valley Wastewater Control System (1976). The purpose of the study was to compare the estimated costs of removing excessive I/I from existing sewerage systems in the project area to the costs of transmitting and treating the I/I at the proposed regional WWTP (Alternative I). The costs of transmission were estimated at $2,050 for each gallon per minute (gpm) of infiltration and $1,592 for each gpm of inflow. It was estimated that 28.84 cfs (18.64 mgd) of interceptor flow and treatment of 3.42 mgd could be eliminated from the existing systems at a lower cost than the cost of providing for such flows in the HVWWCS. The final recommendation of the study was that local Sewer System Evaluation Surveys (SSESs) should be conducted to verify or refute the conclusions presented in the report. Applications for funds to complete these surveys in most project area communities are awaiting State and Federal approval. An SSES is underway for the City of Trenton.

Based on the conclusions of these studies, recommendations will be made on the amount of I/I which can be cost-effectively removed from existing systems. Corrective measures should reduce system flows proportionately.

New sewerage constructed in presently unsewered sections of the project area would be required to meet minimum I/I standards. It therefore is assumed that future wastewater flows will be relatively free of I/I contributions, proportionately reducing the current community per capita flow rates.

### 5.2.1.2. Conservation of Water

Water conservation as a means of reducing wastewater flows is usually difficult to attain and often is only marginally effective. Traditional water conservation practices have proven to be socially undesirable except in areas where water shortages exist. Furthermore, such measures usually succeed in limiting only luxury water usages such as lawn watering, car washing, or swimming pool use which do not impose loads on sanitary sewer systems.

One example of a water conservation measure presently being applied in some water-short areas is the imposition of price controls on water use. Through water metering and the application of escalated charges for excessive use, incentives are created to reduce consumption. Such a program would likely be ineffective in the water-rich southeast Michigan area.

Mandatory water conservation through the imposition of plumbing code restrictions potentially could reduce domestic sewage flows. Restrictions which limit new or replacement toilets to a 3.5 gallon capacity and shower head flow rates to 3 gallons per minute would reduce both water demand and sewage flows. Retrofitting plumbing fixtures with such water saving devices, however, has been shown to be ineffective at times. Experience in the Washington Suburban Sanitary District indicates that unless properly maintained, such devices deteriorate and sometimes adversely affect the operation of the fixture to which they are attached. For example, improperly functioning devices which were designed to reduce the amount of water utilized in flush toilets caused some toilets to fail to flush completely, necessitating a second flush. The result was increased water use instead of conservation.

The various water utilities serving project area communities should monitor water pressures throughout their systems and utilize pressure reducing valves, or similar measures, where water pressures are higher than necessary. This would reduce the use of water and unnecessary wastewater flow. Similarly, the water utility authorities could cooperate with the sewer system authorities in pursuing educational campaigns on the benefits of water conservation. Spot television or radio public service messages, and leaflets enclosed in water and/or sewer bills to residents which discuss the link between water-use conservation, reduction in sewage flow, and the resulting personal cost savings could result in some degree of flow reduction. Reduction in peak flows especially might be attainable. While no reduction of flows as a result of potential water use conservation has been assumed in system alternatives (Section 5.3.), implementation of conservation measures at some future time could reduce flows sufficiently and could extend somewhat the design capacity of the collection and treatment components.

### 5.2.1.3. Diversion of Flows

Some existing flows to sanitary sewers, such as uncontaminated cooling waters, potentially could be diverted. Such waters could be discharged to storm drains, reducing proportionately the flows in the sanitary system. No information presently is available, however, to aid in the estimation of the possible reduction in volume which might be achievable. Diversion of new flows to existing wastewater treatment systems which have adequate conveyance and treatment capacities is another option. At present, the Detroit Metropolitan WWTP is under a court order to expand and upgrade. As a result, the Detroit WWTP should have a limited ability to accept additional future flows from its existing service areas. Redistribution of population and the resulting changes in wastewater flows in the future may provide additional wastewater management options for some communities served by the Detroit WWTP.

The Downriver-Wyandotte WWTP receives contract flows from the City of Belleville and the southern two-thirds of Van Buren Township. The plant presently experiences wet weather hydraulic overflows because of the substantial amount of I/I in the collection system. Future flows at this plant are difficult to predict and diversion of increased project area flows to this system appears to be impractical. The other relatively small wastewater treatment systems in proximity to the project area (such as Wixom, etc.) appear to have very little potential for receiving diverted flows. Therefore, treatment of future project area wastewater flows by those systems cannot be expected and options incorporating such diversions were not carried forward.

### 5.2.1.4. Flow Equalization

Diurnal flow variations in both volume and strength of wastewaters can be reduced by flow equalization. This eliminates the high peak flows which can reduce required interceptor sewer capacity. Temporary storage basins are utilized to hold the daily peak flows for discharge to the downstream system during daily low-flow periods. The part of the wastewater collection system in the City of Novi which discharges to the Middle Rouge Interceptor of the RVSDD utilizes an equalization basin which maximizes use of limited contract capacity. This system has increased the system's capacity by a factor of 2.6 (US-EPA 1974). Utilization of equalization basins by other project area communities should receive further consideration.

### 5.2.1.5. Industrial Pretreatment and/or Reuse

Very little information is available on the quantity of flow or wasteloads contributed to sewer systems by industries in the project area. Options would involve industrial plant modifications to reduce water use and wasteload concentration. Reuse of industrial wastewaters would be unlikely unless the purchase price for industrial makeup or cooling water approached the cost for in-plant wastewater treatment and recycling. US-EPA Pretreatment Guidelines (1973, 1977) are expected to be enforced in the project area. Therefore, no option which includes specific industrial flow or load reductions is included.

### 5.2.2. Collection System

Existing wastewater collection and interceptor systems in the project area were described in Section 3.4. Options for this component address the development of new interceptor sewer systems to service existing and potential new service areas. Indirectly, these options must consider the sewering of presently-unsewered areas, although such actions would be part of independent facility planning efforts by local communities.

As previously stated (Section 5.2.1.3.), facility plans have not been prepared for sewer system construction in presently-unsewered White Lake Township, Commerce Township, or Wolverine Lake. Those areas remaining unsewered in Novi, Northville Township, Plymouth Township, Canton Township, Van Buren Township, Huron Township, or Brownstown Township also would require a facility plan prior to detailed system design. US-EPA's Program Requirements Memorandum (PRM) 78-9 (3 March 1978) specifies that before Federal funding can be approved for construction of new sewage collection systems, the following requirements/criteria must be met:

- The area under consideration for collection sewers must have substantial human habitation in existence on 18 October 1972
- The proposed collection system must abate a public health hazard, a groundwater contamination problem, or a surface water quality violation
- The proposed collection system, including treatment cost, must be cost-effective when compared to other alternatives such as non-sewered solutions
- The proposed system must be designed so that the bulk (generally two-thirds) of the design capacity in the collector sewers will be for wastes originating from communities (habitations) in existence on 18 October 1972
- The project costs must have been displayed publicly or disclosed to the anticipated users.

Although options are being considered which propose interception of wastewater flows from Commerce and White Lake Townships, facility plans have not been prepared to provide a basis for whether or not conditions warrant the construction of sewers. Should sewering these communities be found to be undesirable, interceptor system options would need to be revised to eliminate service to these areas.

A Facility Plan has been prepared for the construction of a sewer system in Sumpter Township (Wade, Trim & Associates, Inc. 1977). "Alternate C" developed in the plan was preliminarily ranked as the most cost-effective alternate for the Township. Total capital cost for the sewer system in the Township plus the interceptor to connect with the proposed Huron Valley Regional Interceptor is $9,461,000. This plan proposes more extensive sewering in Sumpter Township than is considered to be served by the regional interceptor proposals.

Utilization of the existing contract capacities held by project area communities in the RVSDD and Downriver District (DD) was analyzed. Options ranged from maximum use of current capacity allocations (assuming cost effective removal of I/I) to total elimination of project area flows to these systems. Continued flows to the RVSDD and DD potentially would reduce the amount of new capacity required for the HVWWCS and would take advantage of existing investment in wastewater conveyance systems. Redistribution of contract capacities within the project area also was examined. Another consideration was the potential need for eastern RVSDD communities to obtain additional capacity in the Rouge Valley interceptors to reduce their wet weather combined sewer overflow problems. Reduction in flow from the western communities to the Rouge Valley interceptors, therefore, also was considered as an option.

Options which include construction of new east-west interceptors were eliminated because of the limited ability of the Detroit and Wayne County-Wyandotte WWTPs to accept wastewater flows from project area communities in excess of present contract capacities. Therefore, only new interceptor configurations which convey wastewater along north-south alignments were carried forward.

The new north-south regional interceptor alignment tentatively proposed by Wayne County as part of its Alternative III project consists of a 53-mile main-stem interceptor. The northern-most terminus is at the intersection of Cooley Lake and Caroll Lake Roads (White Lake Township-Commerce Township boundary line). From there, the interceptor is routed to the south between Fox Lake and Carrol Lake, and then along the Upper Huron River to Commerce. From there it follows the eastern shoreline of Commerce Lake and angles to a point immediately south of the lake in Oakley Park. It would be tunneled due south under Benstein Road into Novi (west of Walled Lake) to 12-Mile Road. From this point, the existing Oakland County interceptor would be utilized as it parallels the C&O Railroad tracks to 10-Mile Road in central Novi. The existing Middle Rouge interceptor would be utilized from there to Northville. The capacity of the Middle Rouge interceptor would not accomodate all flows added to the system in the Northville area. A parallel, open-cut sewer would be constructed (generally along the C&O Railroad track from south of Northville southerly to

Plymouth). The route would skirt Plymouth to the northeast and east. The Middle Rouge interceptor again would be utilized without additional construction from the intersection of East Hines Drive and Haggerty Road (east of Plymouth) to the intersection of Hannan Road and Joy Road (south of Newburgh Lake). A new interceptor would be tunneled due south under Hannan Road. It would come into close proximity to the Lower Huron River southeast of French Landing. The interceptor would be constructed by the open-cut method along the river, crossing to the west side of the river at the confluence of Griggs Drain where it is joined by the 7.1-mile Van Buren-Sumpter Arm which extends west into Sumpter and Van Buren Townships. This arm of the interceptor would convey flows from Sumpter Township and southern Van Buren Township to the regional system. From Griggs Drain, the interceptor is routed along the Lower Huron River (primarily via open-cut construction) to the proposed WWTP site in southeast Brownstown Township. The plan associated with this interceptor alignment also would require development of a new 4.8-mile force main from the Wayne County-Trenton WWTP to the proposed new WWTP site in southeastern Brownstown Township for conveyance of wastewaters from both the Wayne County-Trenton and the City of Trenton WWTPs (Section 5.2.3.).

There are numerous river crossings proposed along the interceptor route. This is only a tentative route. A more detailed alignment (during "Step II" design) based on environmental factors such as ecologically fragile areas, soil conditions, etc., may be somewhat different.

Other possible north-south interceptor configurations are proposed which utilize the same general route, except that each would be shorter. For example, a 9.0-mile interceptor is proposed to be routed from the northern terminus at Cooley Lake Road via the same route as previously described to a point about 1.0 mile north of 12-Mile Road adjacent to the Walled Lake WWTP. This collection system option would be compatible with the treatment component option to upgrade and expand the Walled Lake WWTP to 4.8 mgd to serve newly-sewered areas in White Lake Township and Commerce Township. Other options include constructing a 26.4-mile main-stem regional interceptor from as far north as central Canton Township to the proposed Brownstown Township WWTP site, or a 40.2-mile interceptor from as far north as central Novi southward to Brownstown Township. Interceptor sizing for the feasibility analysis conducted herein was based on 20-year peak wastewater flow projections, as was done in the HVWWCS Facility Plan (Hubbell, Roth & Clark, Inc. 1976). Consideration in the decision-making process should be given to sizing the regional interceptor for 40- to 50-year design flows. The interceptors proposed herein will have at least a 40- to 50-year physical life. This incorporates the engineering guideline of design for the estimated ultimate tributary population (Great Lakes-Upper Mississippi River Board of State Sanitary Engineers 1971).

## 5.2.3. Wastewater Treatment Processes

The HVWWCS Facility Plan (Hubbell, Roth & Clark, Inc. 1976) considered a variety of treatment options for application in the project area. In general, wastewater treatment options include conventional physical, biological, and chemical processes, or land treatment. The conventional options utilize preliminary treatment; primary sedimentation; secondary activated sludge or trickling filter processes; chemical additions for phosphorus removal; final clarification; and, in instances where additional tertiary treatment is desired, final filtration. These unit processes are followed by disinfection prior to effluent disposal. Land treatment processes include lagoons, slow-rate infiltration or irrigation, overland flow, or rapid infiltration.

The degree of treatment required is dependent on the effluent disposal option selected (Section 5.2.4.). Where effluent disposal of treated wastewater is by discharge to receiving waters, effluent quality limitations determined by MDNR establish the required level of treatment.

### 5.2.3.1. Preliminary Treatment and Primary Sedimentation

All options considered incorporate conventional preliminary treatment and primary sedimentation. These unit processes serve to remove coarse solids, readily settleable suspended solids, floating solids, and grease from the influent wastewater. It is assumed in each treatment option considered that these processes will remove from 50% to 65% of the suspended solids and from 25% to 40% of the $BOD_5$ from the wastewater.

### 5.2.3.2. Secondary Treatment

Secondary treatment processes remove soluable and colloidal sized organic substances from wastewater. The most frequently used are the activated sludge and trickling filter processes (Metcalf & Eddy, Inc. 1972). Lagoons and other land treatment methods also are available, but have more limited applications.

### 5.2.3.2.1. Activated Sludge

The basic activated sludge process consists of aeration units, a secondary clarifier, and a sludge recycle and wasting system. A number of modifications to the basic process exist. Each is specific to different strength wastes. The efficiency of BOD removal by the conventional diffused-air and pure-oxygen system options ranges from 85% to 95%.

Diffused-air systems presently are used at the Walled Lake, City of Trenton, and Flat Rock WWTPs. Continued utilization of this process in alternatives which provide for upgrading and expanding these WWTPs would be cost-effective. Alternatives which propose construction of a new secondary process at the Wayne County-Trenton WWTP and a small, new tertiary plant for southeastern Brownstown Township also include design of a diffused-air activated sludge unit. Alternatives which consider construction of a new regional secondary treatment plant to be located near the mouth of the Huron River in southeastern Brownstown Township include selection of a deep-tank, oxygen-activated sludge process in lieu of the diffused-air system.

### 5.2.3.2.2. Trickling Filter

The trickling filter is a relatively simple biological treatment process. Wastewater is sprinkled over a higly permeable bed of rocks or similar coarse material. As the wastewater percolates through the bed, the biological slime layer growing on the media absorbs and metabolizes the organic wastes.

The City of Rockwood WWTP utilizes a trickling filter tower with a plastic filter media to provide secondary treatment of wastewater. Inspection of the plant and analysis of the monthly plant operation reports by WAPORA during 1977 indicated that effluent quality limitations were not being met. The alternatives which include upgrading and expanding existing WWTPs in the project area include the addition of a tertiary sand filter to the Rockwood WWTP to improve its effluent characteristics. (Enforcement of industrial pretreatment standards also would be required.)

### 5.2.3.2.3. Lagoons

Oxidation and facultative lagoons often are utilized to provide secondary treatment for small wastewater systems. Oxidation lagoons are generally shallow (less than 3 feet) to insure that natural surface reaeration can maintain aerobic conditions. The large land area required for this process eliminated it from consideration in the Huron Valley project area.

Facultative lagoons are deeper (up to 10 feet) and utilize both natural aerobic and anaerobic biological processes in the degradation of organics. This process presently is utilized by Brownstown Township for treatment of wastes generated in southeastern Brownstown Township. The present lagoons (19 acres) are inadequate. This option is not considered further.

Mechanical surface aeration units can be utilized to insure increased rates of atmospheric oxygen transport into the waters of the lagoon. With this system, deeper lagoons can be utilized reducing the surface area requirement somewhat. This process, however, cannot produce the high quality of effluent required by the MDNR for continued discharge to Silver Creek (tributary to the Lower Huron River) and is rejected.

### 5.2.3.2.4. Land Treatment

Land treatment of wastewater is a viable alternative when soil conditions and groundwater levels are suitable. Land treatment options have been eliminated as a proposed regional wastewater treatment process (treatment for more than 10 mgd) because of the large land areas required, the excessive costs, and the lack of social acceptability (Hubbell, Roth, & Clark, Inc. 1976; Giffels/Black & Veatch 1977d). Some potential may exist for smaller land treatment systems in proximity to central or northern project area communities. For example, White Lake Township may be able to utilize a land treatment system if sewers are constructed. Further investigation of the feasibility of such an alternative treatment option through the facility planning process is required before it can be considered further.

### 5.2.3.3. Advanced Wastewater Treatment

Advanced wastewater treatment is required in alternatives which include continued discharge of effluent to the Lower Huron River by existing WWTPs and by the Walled Lake WWTP (Section 5.2.4.). A tertiary sand filter unit process as part of the upgrading and/or expansion of the Flat Rock, Rockwood, and southeast Brownstown Township WWTPs is being considered.

All alternatives must incorporate phosphorus removal. Presently project area WWTPs employ the conventional chemical addition of alum, lime, ferric chloride, or industrial waste pickle liquor to achieve phosphorus removal. This process will be retained, except in conjunction with the Walled Lake WWTP. The 12 pounds per day total effluent phosphorus limitation imposed by MDNR (Section 5.2.4.) on the Walled Lake WWTP requires a two-stage lime process. This process would provide removal efficiencies of up to 98%, when coupled with a final multi-media filtration process (US-EPA 1976a).

### 5.2.3.4. Disinfection

Disinfection of treated effluent traditionally has been used to eliminate disease causing bacteria and viruses. The conventional disinfection process has been chlorination.

Ozonation can be utilized as an alternative disinfection process. This option does not present a danger to aquatic life, but is several times more expensive than the chlorination process. Pilot plant studies have shown that it is difficult to achieve consistently high levels of disinfection with ozone when the process is applied to secondary effluent. Tertiary filtration is required prior to ozonation to increase its efficiency (US-EPA 1976b). For these reasons, ozonation has been eliminated from further consideration.

### 5.2.4. Effluent Disposal Methods and Sites

Three WWTP effluent disposal options are available: discharge to receiving waters, disposal on land, and reuse. Of the three, only the first presently is considered feasible in the project area. Disposal on land is not feasible for the same reasons that land application as a treatment process was rejected (Section 5.2.3.4.). Reuse would require costly advanced wastewater treatment and sufficient economic incentive is not available to justify the expense.

No new WWTP effluent discharge is permitted to the Upper Huron River upstream from Proud Lake or to the upper Middle River Rouge upstream from Newburgh Lake (By letter, MDNR to Hubbell, Roth, & Clark, Inc. 29 January 1976). The MDNR also has limited total phosphorus loadings in the effluent discharged from an expanded Walled Lake WWTP to 12 pounds per day (By letter, MDNR to Mr. Donald D. Ringer, Director, Oakland County Department of Public Works 22 November 1976).

Siting a new WWTP adjacent to the Huron River at French Landing (downstream from Belleville Lake) was proposed as an alternative WWTP site in the Facility Plan (Hubbell, Roth, & Clark, Inc. 1976). Effluent from such a WWTP would create a potential public health hazard. The Michigan Department of Public Health (By letter, MDPH to the Washtenaw and Wayne County DPWs, 13 April 1976) declared that "downstream use of water for water supply at Flat Rock is not compatible with the proposed wastewater facility at French Landing". The site at French Landing was eliminated from further consideration.

The MDNR also has established effluent criteria for potential future discharges of wastewater effluent to the Lower Huron River, to the Detroit River, and to Lake Erie (By letter, MDNR to Hubbell, Roth, & Clark, Inc. 29 January 1975). These criteria recommend treatment in excess of standard secondary treatment (defined as 30 mg/l, 30-day average $BOD_5$ and SS) for effluent discharged from an expanded Flat Rock WWTP and from the Rockwood WWTP. A small new Brownstown Township WWTP for southeast Brownstown Township discharging to Silver Creek and thence into the Lower Huron River would need to meet tertiary effluent requirements (maximum of 10 mg/l $BOD_5$ and 15 mg/l SS). A new regional WWTP discharging to Lake Erie and the City of Trenton and Wayne County - Trenton WWTPs which discharge to the Detroit River would need to meet secondary treatment standards.

### 5.2.5. Sludge Processing and Disposal

The removal of solids from influent wastewater by each of the wastewater treatment processes discussed (Section 5.2.3.) creates a need for management of the residual sludge. This sludge is largely organic, but significant amounts of inert chemicals are present when phosphorus removal is practiced. A typical sludge management program involves interrelated processes for reducing the volume of the sludge (which is mostly water) and final disposal.

Volume reduction depends on reducing both the water and organic content of sludges. Organics can be reduced through the use of digestion, incineration, pyrolysis, or wet oxidation processes. Moisture reduction is attainable through concentration, conditioning, dewatering, and/or drying processes. The selected mode of final disposal determines which processes are required.

#### 5.2.5.1. Digestion

Sludges can be digested by either aerobic or anaerobic processes. Aerobic digestion is attained by bacterial oxidation of organic material to carbon dioxide and water. The process requires high energy inputs to maintain aerobic conditions in sludge digestion tanks and is not cost effective for larger systems.

Anaerobic digestion is more commonly used. During anaerobic digestion, organics in the sludge are reduced to methane, carbon dioxide, hydrogen sulfide, and other products. This process requires from 10 days to several months of detention time in sealed reactors, depending on the specific system design. For regional WWTPs, this would require a large number of digestors and a correspondingly large land area. Digestion is of questionable feasibility for alternatives which include a new regional WWTP. The small land areas available at the Flat Rock, Rockwood, Trenton, and Wayne County-Trenton WWTPs and their existing dependence on alternative off-site disposal systems preclude anaerobic digestion as a viable option for existing plant expansion alternatives.

#### 5.2.5.2. Incineration

Incineration converts sludge to an inert ash. If adequate dewatering is provided prior to incineration, the process proceeds without the need for a significant amount of supplemental fuel. Restraints on incinerators for sludge disposal are the need for atmospheric emission controls, odor control, ash disposal, and intensive maintenance.

Various incineration processes are being utilized in sludge management, including multiple hearth, fluidized bed, rotary kiln, and cyclonic reactor processes. Multiple hearth incineration is the most widely utilized method for WWTPs between 10 mgd and 100 mgd. Cyclonic reactors are best suited for small WWTPs (less than 500 lb/hr of sludge) where site land area is restricted. The rotary kiln process can be designed for a wide range of capacities, but is most cost effective for plants larger than 100 mgd. The fluidized bed process has had limited application.

#### 5.2.5.3. Pyrolysis

Pyrolysis is a process which involves heating solid waste (sludge) in the absence of oxygen to produce a char and other inert material, and a variety of condensable and noncondensable gases. The process can effectively recover some of the energy in the sludge. Useful by-products in addition to energy often can be recovered from the process. The technology is still in a developmental status, but several pilot plants presently are operational. The Detroit Overview Plan for wastewater treatment facilities and sludge disposal (Giffels/Black & Veatch 1977e) recommended that the City of Detroit install a pilot pyrolysis plant to test the potential of the process as the City's ultimate sludge processing system. The pilot plant has not been constructed as of 1 August 1978. Because of the experimental nature of this technology and the uncertainty of its relative economics, it is not considered further herein.

#### 5.2.5.4. Wet Oxidation

This process utilizes elevated temperature and pressure to oxidize new sludge. The final products are gases, liquids, and ash. The liquid and solids must be separated on sand beds or in settling tanks. Through proper design, thermal self-sufficiency can be achieved (Metcalf & Eddy, Inc. 1972). This process has had very limited application and was not included in system alternatives.

### 5.2.5.5. Concentration of Sludge

Concentration of sludge is a thickening process utilized to reduce the overall volume. For example, concentrating a new sludge with a solids content from 1% to 4% of total weight would reduce the sludge volume by 25%. Sludge thickeners usually are mechanical, although dissolved-air floatation is used. This process option must be combined with other volume reducing processes to be effective, except when used as a process step prior to land disposal of liquid sludge.

### 5.2.5.6. Conditioning

Conditioning is a process used to improve the dewatering characteristics of a sludge. This is accomplished through chemical addition or heat treatment. This process is applied prior to vacuum filtration or centrifugation processes.

### 5.2.5.7. Dewatering and Drying

Dewatering and drying processes are selected when the sludge disposal requires a semi-solid rather than a liquid sludge. The most common dewatering processes include use of drying beds, vacuum filtration, centrifugation, and pressure filtration.

Drying beds require large land areas and are weather dependent which causes this option to be infeasible for the proposed regional WWTPs in the project area. Vacuum filtration is the most widely used mechanical system. The final dewatered product can be used as a soil conditioner or low-grade fertilizer, or can be incinerated. Centrifugation mechanically separates sludge cake from centrate and can achieve solids concentrations of from 15% to 40% which is suitable for land disposal or incineration. Pressure filtration "squeezes" water out of sludge in a filter press. Hubbell, Roth & Clark, Inc. (1976) selected vacuum filtration as the most cost-effective and reliable sludge dewatering system for the Huron Valley wastewater control system.

Heat drying to reduce moisture content primarily is applied as an initial step in the incineration process. It, therefore, is included as part of the incineration process in the discussion of alternatives.

### 5.2.5.8. Land Disposal

Sludges can be incorporated into soils, lagooned, or landfilled if suitable sites are available. The humus in digested sludges is a beneficial soil conditioner and improves soil moisture retention. Digested sludges also can be heat dried, ground, and fortified with nitrogen to produce fertilizer. When the WWTP is in a remote location, lagooning can be selected as a low-cost alternative. An appropriate site does not exist in the project area.

Landfilling of raw or digested sludge can be practiced if landfill sites are available. Raw sludges would require disposal in a sanitary landfill to eliminate odors. Dumping of digested sludges in abandoned quarries, such as the silica pits near the proposed regional WWTP site, also has potential as a final disposal option. Environmental Consultants, Inc. (1977) concluded "that there are land areas suitable for the application of a portion of the residues generated in the (SEMCOG) region provided that proper consideration is given to the environmental character of the proposed application site and to balancing the rates of application with the soil and vegetative capacity to assimilate the residuals. Presently, there is one municipality in the region applying residues to the land surface. More widespread employment in the region is apparently constrained by the variability in regulation and by real and imagined concerns of adverse public reaction".

Identification of specific sites for the land application of sludge is beyond the scope of the EIS. The potential, however, exists for land application.

## 5.3. System Alternatives

Feasible and compatible sets of component options were combined into system alternatives. The alternatives represent combinations of conveyance options for various wastewater flows, different treatment processes, siting options, effluent disposal options, and sludge processing and disposal options. Each alternative represents a somewhat different level or quality of service for the project area. The components and construction and operation costs of the alternatives are presented in the following sections.

The capital cost of the implemented alternative would be shared 80% by the Federal (75%) and State (5%) Construction Grants Programs and 20% by local participants. Annual operation and maintenance costs would be financed entirely by local users of the system. The local share of capital costs probably would be paid for with county revenue bonds. Bond retirement could be accomplished by the participating communities through the collection of user fees, by applying special assessments, or by other means (Section 6.1.2.). All cost data are based on January 1979 price levels.

### 5.3.1. Alternative A

Alternative A represents the Wayne County DPW's recent proposal for a modified regional wastewater management system to serve the majority of the project area. Two versions of Alternative A have been examined. The first, designated Alternative A-1 herein, represents the DPW's proposed "Alternate III-Modified Wayne/Oakland Segment" (III-M). The projected population to be served, schedule for joining the system, interceptor sewer sizes and costs, and the proposed treatment plant capacity presented in Alternative A-1 were developed by the DPW and its consultants.

The second version of Alternative A, Alternative A-2, incorporates the conceptual design of Alternative III-M. Alternative A-2, however, is based on the SEMCOG population projections disucssed in Section 3.1.2. Based on these projections and supplemental estimates by SEMCOG of the future number of sewered households, sewer service projections for the year 1995 were developed. These forecasts indicated a future need for wastewater treatment service by project area communities which was substantially different than community requirements under Alternative A-1. Proposed interceptor sewer and regional treatment plant capacity requirements were recalculated. Alternative A-2 also deviates from A-1 in that Plymouth is considered a participant in the regional system, Canton Township and Van Buren Township would discontinue their participation in the Rouge Valley

Sewage Disposal District (RVSDD), and Van Buren Township would discontinue its use of the Downriver District (DD). Both Canton and Van Buren Townships would rely entirely on capacity in the Huron Valley System.

### 5.3.1.1. Alternative A-1

#### 5.3.1.1.1. Components

This alternative proposes that the Wayne County DPW's projected ultimate population of 374,808 (Table 15) for the project area (except White Lake Township, Wolverine Lake Village in Commerce Township, Plymouth, and Belleville) would be provided capacity in the proposed regional interceptor sewer. (The four communities named had expressed a desire not to participate in the regional system.) Participating project area communities which hold contracts for capacity in the RVSDD (Novi, Northville, Northville Township, Plymouth Township, Canton Township, and Van Buren Township) and the DD (Van Buren Township) would continue to rely on these systems to various degrees until 1995. The DPW's schedule for utilization of capacity in the new system by these communities is presented in Table 15.

The 50-mile, north-south regional interceptor proposed in this alternative would begin on the east side of Commerce Lake in Commerce Township (Figure 8). At this point, the interceptor would collect flows from the northern part of the project area including Commerce and northern Commerce Township when their local collection systems are constructed and are operational.

The interceptor would be routed to the southwest and south, following the route described in Section 5.2.2. It would intercept the flows from the Walled Lake WWTP (from the community of Walled Lake and from northeastern Novi). The northern arm of the new interceptor is proposed to connect to the existing Oakland County Interceptor in Novi (at Chattman Drive at Ennishore). This would eliminate the need for new construction south to Northville. This segment would convey flows from the other sewered areas in Novi.

In Northville, the Oakland County interceptor joins the Wayne County Middle Rouge Interceptor, which presently conveys wastewater from Novi via the Rouge Valley Interceptor system to the Detroit System. The capacity of the Middle Rouge Interceptor from southern Northville to just east of Wilcox Lake is not adequate to convey both the existing and future flows from the northern segment of the new interceptor and the flows from Novi, Northville, Northville Township, and Plymouth Township. Therefore, a parallel sewer is needed.

The Hannan Road segment of the new interceptor would branch from the Middle Rouge Interceptor southeast of Plymouth (where Joy Road intersects the Plymouth-Livonia corporate boundary). It would divert all flows from the Middle Rouge Interceptor including Plymouth's except the 37.48 cfs maximum flow contracted in the RVSDD by Novi (4.0 cfs), Northville (3.6 cfs), Northville Township (2.6 cfs plus 5.41 cfs reserved for state institutions in the township), Plymouth (4.8 cfs), Plymouth Township (9.6 cfs), and Canton Township (7.47 cfs).

The Hannan Road interceptor, from Joy Road south to the Huron River in Van Buren Township, is proposed to be tunneled. Near the Lower River Rouge in Canton Township, the Hannan Road Interceptor would interconnect with the

Table 15. Projected sewered population to be served by Alternatives A-1 and A-2 for the Huron Valley Wastewater Control System, Michigan.

| COMMUNITY | Alternative A-1 | | Alternative A-2 | |
|---|---|---|---|---|
| | 1995 Projected Sewered Population[1] | Year Projected to Join New System[1] | 1995 Projected Sewered Population[2] | Year Projected to Join New System[1] |
| **Oakland County** | | | | |
| White Lake Township | -0-[3] | -- | -0-[3] | -- |
| Commerce Township | 27,000 | 1980 | 12,700 | 1980 |
| Wolverine Lake | -0-[3] | -- | -0-[3] | -- |
| Walled Lake | 7,000 | 1980 | 3,800 | 1980 |
| Novi | 44,073 | 1980[4] | 20,100 | 1980 |
| Subtotal | 78,073 | | 36,600 | |
| **Wayne County** | | | | |
| Northville | 5,000 | 1995[4] | 5,900 | -- |
| Northville Twp. | 38,975 | 1985[4] | 22,600 | -- |
| Plymouth Twp. | 26,000 | 1985[4] | 23,150 | -- |
| Plymouth | -0-[3] | -- | 12,450 | -- |
| Canton Twp. | 44,448 | 1990[4] | 60,400 | 1980 |
| Van Buren Twp. | 43,029 | 1980[4] | 44,000 | 1980 |
| Belleville | -0-[3] | -- | -0-[3] | 1980 |
| Romulus | 2,544 | 1980 | 2,550 | 1980 |
| Sumpter Twp. | 18,196 | 1980 | 17,400 | 1980 |
| Huron Twp. | 23,635 | 1980 | 18,600 | 1980 |
| Flat Rock | 14,152 | 1980 | 12,600 | 1980 |
| South Rockwood (Monroe County) | 1,784 | 1980 | 2,800 | 1980 |
| Rockwood | 5,747 | 1980 | 3,600 | 1980 |
| Brownstown Twp. (South) | 5,350 | 1980 | 6,800 | 1980 |
| Brownstown Twp. (Central) | 10,000 | 1980 | 27,350 | 1980 |
| Woodhaven | 12,822 | 1980 | 9,650 | 1980 |
| Trenton | 36,863 | 1980 | 22,150 | 1980 |
| Gibraltar | 8,190 | 1980 | 4,050 | 1980 |
| Subtotal | 296,735 | | 296,050 | |
| Total | 374,808 | | 332,650 | |

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[1] Contained in 12 April 1977 letter from Mr. George R. Bingham, Director, Wayne County Board of Public Works to participating communities.

Table 15. (continued).

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[2] Based on an alternative population projection (see Section 3.1.2.), estimates of future sewered households by SEMCOG (1978), and estimate of existing households which would connect to new sewer systems by WAPORA, Inc.

[3] Plymouth and Belleville are sewered but indicated they would not participate in the Huron Valley System. White Lake Township and the Village of Wolverine Lake are not sewered and indicated they would not participate (12 April 1977 letter from Mr. George R. Bingham, Director, Wayne County Board of Public Works to participating communities).

[4] These communities would continue to utilize their capacity in the RVSDD until 1995 and only contribute flows in excess of that capacity to the new regional interceptor.

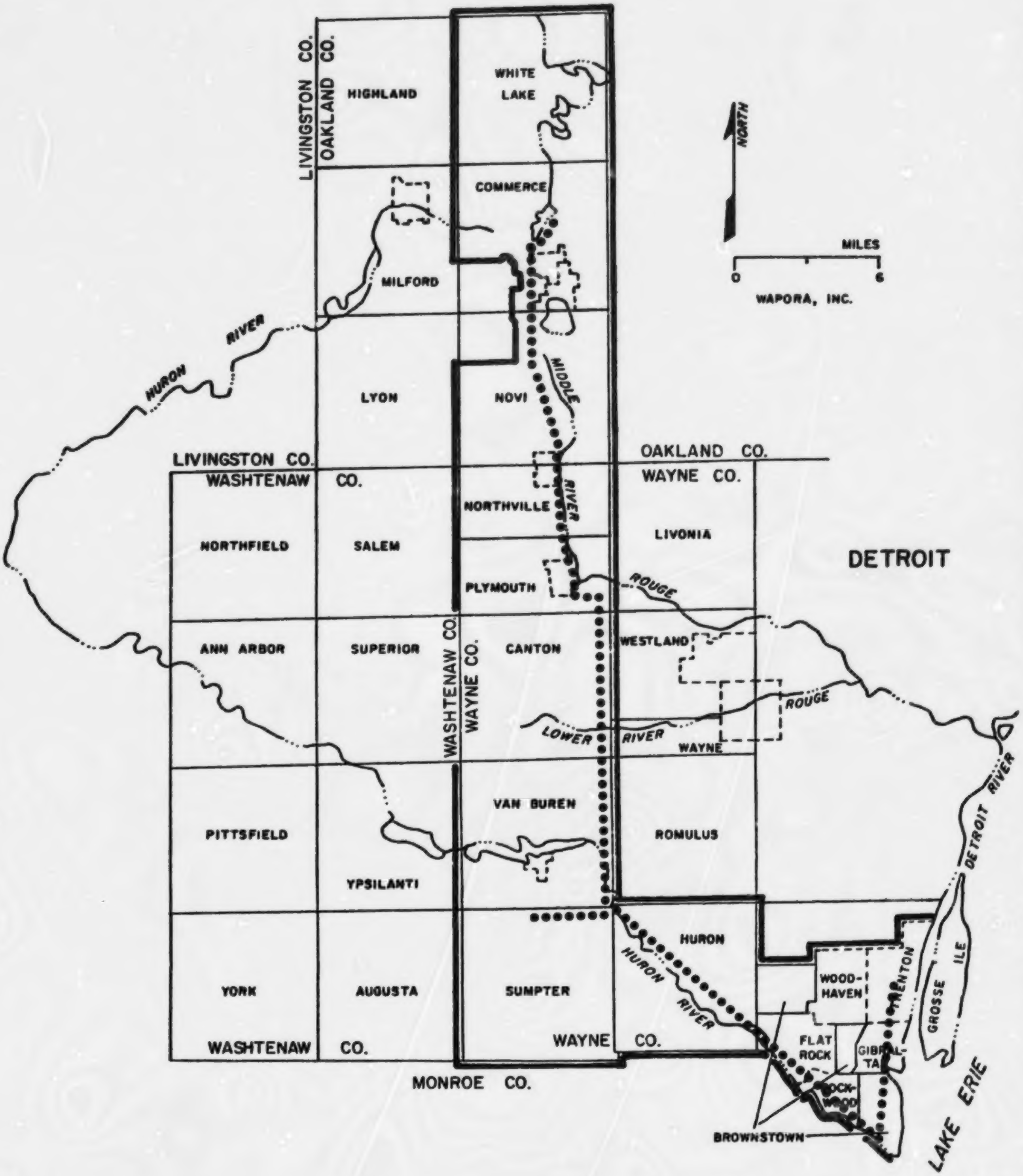
LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
NORTH
MILES
0
6
WAPORA, INC.
COMMERCE
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE RIVER
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
NORTHVILLE
LIVONIA
DETROIT
NORTHFIELD
SALEM
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
LOWER RIVER ROUGE
WAYNE
DETROIT RIVER
VAN BUREN
PITTSFIELD
ROMULUS
YPSILANTI
HURON
YORK
AUGUSTA
SUMPTER
HURON RIVER
WOOD-HAVEN
TRENTON
GROSSE ILE
WASHTENAW CO.
WAYNE CO.
FLAT ROCK
GIBRALTAR
ROCKWOOD
MONROE CO.
BROWNSTOWN
LAKE ERIE

Figure 8. Alternatives A-1 and A-2; the conceptual route of the proposed interceptor sewer systems is shown by the dotted line. The Huron Valley project area is delineated by the heavy black line.

Lower Rouge Interceptor to serve Canton and Northern Van Buren Townships. Flows in excess of the 10.1 cfs contract capacity in the RVSDD from Canton (6.9 cfs) and Van Buren (3.2 cfs) Townships would be diverted to the new interceptor.

From the junction of the Hannan Road segment of the regional interceptor with the Huron River, the interceptor would be routed to the southeast along the river. As proposed, it would cross the Huron River 15 times before reaching the site of the proposed regional WWTP in southeast Brownstown Township. This section of interceptor, and the 7.1-mile Sumpter-Van Buren and 4.8-mile Trenton Arms (Figure 8) would be constructed by the open-cut method (Section 5.2.2.). This segment would convey flows from the remainder of Van Buren Township, from Sumpter, Huron, and Central and Southern Brownstown Townships; and from Flat Rock, Rockwood, South Rockwood, Trenton, Woodhaven, and Gibraltar, as well as those flows contributed to the sections of the regional interceptor described previously.

It is assumed that new local sewer systems will be relatively free of I/I. It also is assumed that the amount of I/I presently experienced in existing collection systems which can be cost-effectively removed (Section 5.2.1.) will be eliminated by the time the new interceptor is operational. Additionally, it is assumed that all industrial wastewater contributions to local collection systems will meet applicable pretreatment requirements (US-EPA 1973 and 1977).

Alternative A-1 requires abandonment of the six operating WWTPs in the project area. These plants would be replaced by a proposed new 49.2 mgd regional WWTP. The plant would provide conventional pretreatment, primary sedimentation, and activated sludge secondary treatment. Phosphorus would be reduced to less than 1 mg/l in the effluent by chemical addition. The effluent would be disinfected with chlorine and discharged via a 10,000-foot outfall sewer to the mid-channel of the Detroit River. Sludge generated by the various treatment processes would average 38 tons per day (dry weight basis). It would be dewatered by vacuum filtration and incinerated on-site in a multiple hearth furnace. Ash from the incineration would average 7 tons per day and would be disposed of at an unspecified landfill.

#### 5.3.1.1.2. Construction and Operation Costs

Capital costs for construction of new interceptors and treatment facilities for Alternative A-1, their estimated salvage value after the 20-year analysis period, and the average annual operation and maintenance costs (O&M) are presented in Table 16. (The estimated total capital cost for the WWTP was recalculated by WAPORA, Inc. and is considerably greater than the cost estimate by the facilities planning consultant). Costs which would exist for other aspects of wastewater management in the project area and which must be considered to ensure an equitable comparison among alternatives include: (1) the cost for continued diversion of up to 14.4 mgd to the RVSDD, (2) Belleville and Van Buren Township's continued use of the DD, (3) the remaining debts on WWTPs which are to be abandoned, (4) the investment in new septic tanks for new households in Wolverine Lake and White Lake Township which would be served by sewers in other regional alternatives, (5) the estimated average annual cost of continued maintenancy of all existing and new septic tanks which would otherwise be replaced by sewer service in this area in other regional alternatives, and (6) the cost of constructing local collection sewers in area proposed to be sewered in Alternative A-1. Estimates of these costs for the 20-year analysis period are:

| | | Average Annual Cost ($ x 1,000) |
|---|---|---|
| (1) | Continued use of RVSDD | |
| | -Treatment of an average 14.4 mgd at the Detroit Metropolitan WWTP | 1,639 |
| | -Principal and interest on 47.58 cfs capacity in RVSDD | 101 |
| (2) | Belleville and Van Buren Township's continued use of DD | |
| | -Treatment of an average 3.2 mgd at the Wyandotte WWTP | 408 |
| | -Principal and interest on 8.0 cfs capacity in DD | 32 |
| (3) | Abandoned WWTPs' debt retirement | |
| | Walled Lake WWTP | 30 |
| | Flat Rock WWTP | 13 |
| | Rockwood WWTP | 9 |
| | City of Trenton WWTP | -0-(no outstanding debt) |
| | Wayne County-Trenton WWTP | -0-(no outstanding debt) |
| | Brownstown Lagoons | Unknown |
| (4) | Estimated cost for new septic tanks | 92 |
| (5) | Estimated maintenance cost for septic tanks | 560 |
| (6) | New local collection sewers | Unknown |
| | | 2,884 |

The cost for new local collection systems or additions to existing systems is not available presently. Local facility planning will be required to generate these estimates and to justify their need. All of these costs will be borne by local interests, with the exception of local collection sewers eligible for 80% Federal and State funding.

Although communities would continue to use their existing contract capacities in the RVSDD and in the DD until 1995, and only would rely on the new interceptor for excess flows, they still would be required to pay their share of the capital costs for the interceptor capacity reserved for their future needs (after 1995).

### 5.3.1.2. Alternative A-2

#### 5.3.1.2.1. Components

Alternative A-2 would serve the same communities as would Alternative A-1 (Section 5.3.1.1.1.). The maximum population projected to be provided sewer service by this alternative is 332,650 versus 374,808 by Alternative A-1.

Table 16. Estimated system cost for Alternative A-1.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor (by segment) | | | |
| North Arm (Oakland County) | 11,628 | 5,814 | |
| North Arm (Wayne County) | 3,820 | 1,910 | |
| Hannan Road | 22,760 | 11,380 | |
| Van Buren - Sumpter Arm | 3,702 | 1,851 | |
| Sumpter Township Connection | 108 | 54 | |
| Lower Huron | 23,725 | 11,862 | |
| Trenton Arm | 1,382 | 691 | |
| Trenton Pump Station | 1,500 | 300 | 123 |
| B. Treatment | | | |
| 49.2 mgd WWTP | 76,197 | 15,239 | 4,520 |
| 10,000-foot outfall sewer | 5,810 | 2,905 | |
| TOTAL | 150,632 | 52,006 | 4,643 |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 37,658 | | |
| | 188,290 | | |
| D. Interest During Construction (3 years) | 18,711 | | |
| E. Total Capital Cost | 207,001 | | |
| F. Less Present Worth of Salvage Value | - 14,416 | | |
| G. Net Capital Cost | 192,585 | | |
| H. Present Worth of O&M | 50,632 | | |
| Total Present Worth | 243,217 | | |
| I. Estimated Total Average Annual Equivalent Cost | 22,303 | | |

J. Cost per 1,000 gallons = $1.24

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[1] All interceptor and outfall sewer costs are from "Huron Valley Project, Alternative III Modified" as revised 16 September 1977 by Hubbell, Roth & Clark, Inc.; WWTP costs are derived from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976) adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operational condition.

The proposed route of the interceptor sewer in Alternative A-2 is identical to that of Alternative A-1 (Figure 8). Disposition of contract capacities in the RVSDD and DD, however, would be somewhat different than in Alternative A-1. Only Northville, Plymouth, and Northville and Plymouth Townships would continue to utilize their contract capacities in the RVSDD (26.01 cfs). Flows in excess of this capacity would be conveyed to the new Huron Valley Interceptor. Belleville would continue to rely on its purchased capacity in the DD. All flows from Van Buren Township would be diverted to the Huron Valley System. The Hannan Road segment of the Huron Valley Interceptor would divert all flows generated in northeastern Canton Township and in sewered areas to the north in the project area except the 26.01 cfs which would continue to flow via the Middle Rouge Interceptor to the Detroit System. All flows from Canton Township and Van Buren Township presently conveyed via the Lower Rouge Interceptor to the Detroit System would be diverted to the new Huron Valley System.

The six existing WWTPs in the project area would be abandoned. The new Huron Valley Interceptor would divert flows presently routed to the six existing WWTPs to the proposed regional WWTP. The new plant would have a 37 mgd design capacity and would employ the same treatment processes as Alternative A-1. Sludge production at the regional plant would average about 29 tons per day (dry weight). Approximately 6 tons per day of ash would remain after incineration and would require disposal.

5.3.1.2.2. Construction and Operation Costs

Capital costs, salvage values, and average annual O&M are presented in Table 17. Costs arising from other aspects of wastewater management include: (1) the cost for continued diversion of 26.01 cfs to the RVSDD, (2) Belleville's continued use of the DD, (3) the remaining debt on WWTPs which are to be abandoned, (4) the investment in septic tanks for new households in Wolverine Lake and White Lake Township which would be served by sewers in the other regional alternatives, (5) the estimated average annual cost of continued maintenance of all existing and new septic tanks which would otherwise be replaced by sewer service in this area in other regional alternatives, and (6) the cost of constructing local collection sewers in areas proposed to be sewered in this alternative. Estimates of these costs for the 20-year analysis period are:

| | Average Annual Cost ($ x 1,000) |
|---|---|
| (1) Continued use of RVSDD | |
| -Treatment of an average 6.72 mgd at the Detroit Metropolitan WWTP | 765 |
| -Principal and interest on 26.01 cfs capacity in RVSDD | 42 |
| (2) Belleville's continued use of DD | |
| -Treatment of an average 0.94 mgd at the Wyandotte WWTP | 120 |
| -Principal and interest on 2.8 cfs capacity in DD | 11 |

|  |  | Average Annual Cost ($ x 1,000) |
|---|---|---|
| (3) | Abandoned WWTPs' debt retirement |  |
|  | Walled Lake WWTP | 30 |
|  | Flat Rock WWTP | 13 |
|  | Rockwood WWTP | 9 |
|  | City of Trenton WWTP | -0-(no outstanding debt) |
|  | Wayne County-Trenton WWTP | -0-(no outstanding debt) |
|  | Brownstown Lagoons | Unknown |
| (4) | Estimated cost for new septic tanks | 92 |
| (5) | Estimated maintenance cost for septic tanks | 560 |
| (6) | New local collection sewers | Unknown |
|  |  | 1,642 |

The cost for new local collection systems or additions to existing systems is not available presently. Local facility planning will be required to generate these estimates and justify their need. Twenty percent of the total cost of these systems will be borne by local interests (where such systems are eligible for Federal and State funding).

### 5.3.2. Alternative B

### 5.3.2.1. Components

Alternative B conceptually represents Wayne County's original Alternative III (Hubbell, Roth & Clark, Inc. 1976). A projected 364,500 persons in the project area would be served by the regional system. This includes the 332,650 sewered population served by Alternative A-2 plus 23,000 projected to be sewered by 1995 in White Lake Township, 4,100 in Wolverine Lake, and 4,750 in Belleville. It is assumed that communities will proceed with facility planning with the intent to build and connect to the HVWWCS.

The six existing WWTPs would be abandoned under this alternative and all flows would be diverted to the new interceptor. All capacity in the RVSDD and DD owned by project area communities would be sold to eastern (downstream) communities.

The 53-mile long, north-south regional interceptor proposed in this alternative would be routed as far north as the White Lake Township boundary (intersection of Cooley Lake and Carroll Lake Roads; Figure 9). It would receive flows from White Lake Township conveyed via new local trunk sewers. Proceeding south, the interceptor is proposed to be routed between Fox Lake and Carroll Lake, and then along the Upper Huron River to Commerce. Thence, the interceptor would be routed and constructed in the same general

Table 17. Estimated system cost for Alternative A-2.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor (by segment) | | | |
| North Arm | 14,662 | 7,331 | |
| Hannan Road | 19,765 | 9,883 | |
| Lower Huron | 19,555 | 9,778 | |
| Van Buren-Sumpter Arm (includes Sumpter Connection) | 3,810 | 1,905 | |
| Trenton Arm | 1,382 | 691 | |
| Trenton Pump Station | 1,500 | 300 | 123 |
| B. Treatment | | | |
| 37 mgd WWTP | 56,323 | 11,265 | 3,258 |
| 10,000-foot outfall sewer | 5,810 | 2,905 | |
| Total | 122,807 | 44,058 | 3,381 |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 30,702 | | |
| | 153,509 | | |
| D. Interest During Construction (3 years) | 15,255 | | |
| E. Total Capital Cost | 168,764 | | |
| F. Less Present Worth of Salvage Value | -12,213 | | |
| G. Net Capital Cost | 156,551 | | |
| H. Present Worth of O&M | 36,870 | | |
| Total Present Worth | 193,421 | | |
| I. Estimated Total Average Annual Equivalent Cost | 17,737 | | |

J. Cost per 1,000 gallons = $1.31

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[1] Interceptor and outfall sewer unit costs are based on Hubbell, Roth & Clark, Inc. (1976); WWTP costs derived from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment, and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976) adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operational condition.

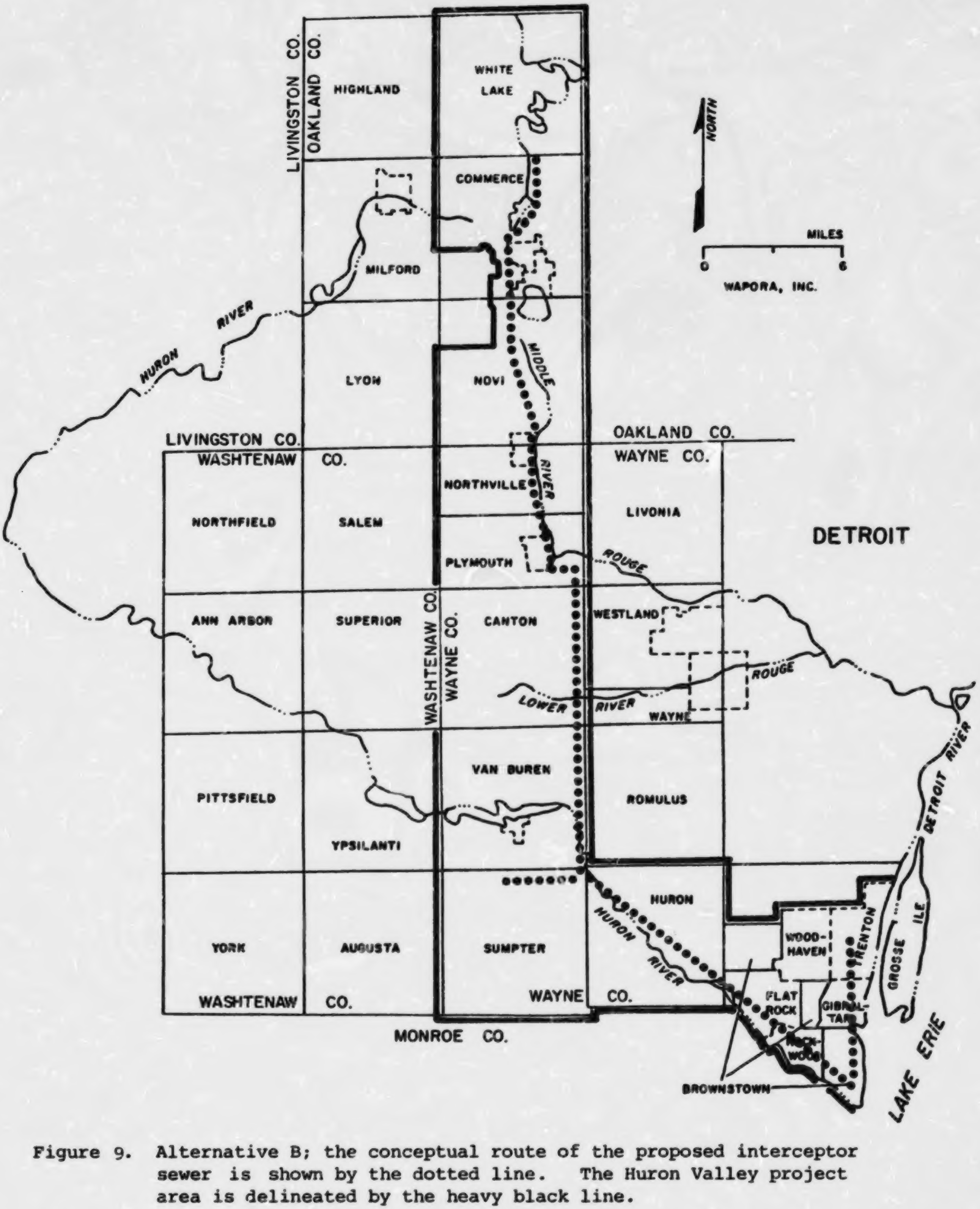
LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
COMMERCE
NORTH
MILES
0
6
WAPORA, INC.
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
NORTHVILLE
RIVER
NORTHFIELD
SALEM
LIVONIA
DETROIT
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
ROUGE
LOWER
RIVER
WAYNE
VAN BUREN
DETROIT RIVER
PITTSFIELD
ROMULUS
YPSILANTI
HURON
HURON
RIVER
YORK
AUGUSTA
SUMPTER
WOOD-HAVEN
TRENTON
GROSSE ILE
WASHTENAW CO.
WAYNE CO.
FLAT ROCK
GIBRAL-TAR
MONROE CO.
ROCK-WOOD
LAKE ERIE
BROWNSTOWN

Figure 9. Alternative B; the conceptual route of the proposed interceptor sewer is shown by the dotted line. The Huron Valley project area is delineated by the heavy black line.

manner as proposed in Alternative A. The parallel sewer required to increase the capacity of the segment of the existing Middle Rouge Interceptor from Northville to Plymouth would need to be somewhat larger. Similarly, the Hannan Road and Lower Huron River segments of the proposed regional interceptor would be larger. The same flow and wasteload reduction options assumed for Alternative A have been assumed.

Alternative B would use the same regional WWTP site in southeastern Brownstown Township. The capacity of the plant, however, would be 47.4 mgd. Treatment processes and method of effluent discharge would be the same as for Alternative A. Total sludge generated by the various treatment processes would average 37 tons per day. After incineration, about 6 tons per day of residual ash would require disposal at an unspecified landfill.

#### 5.3.2.2. Construction and Operation Costs

The total estimated captial costs for construction of new facilities proposed in this alternative, the estimated salvage value after 20 years of use, and the estimated average annual O&M costs are presented in Table 18. The abandonment of the existing WWTPs would cost an average of $52,000 per year over the next 20 years (Section 5.3.1.1.2.). The cost for local collection systems is presently unknown.

### 5.3.3. Alternative C

#### 5.3.3.1. Components

Alternative C would serve the same sewered population as Alternative B, except that the communities from northern Novi to White Lake Township would be served by an expanded and upgraded Walled Lake WWTP instead of the regional system. A new 9.0-mile long interceptor would be routed from the southern White Lake Township boundary to the Walled Lake WWTP via the same general alignment proposed for the Northern Arm of the regional interceptor in Alternative B (Figure 10). The remainder of the project area would be served by a 40.2-mile main-stem regional interceptor which incorporates the existing Oakland County and Middle Rouge Interceptors. The proposed new Hannan Road and Lower Huron River segments, and the Van Buren and Trenton Arms of the regional interceptor would be routed and constructed in the same manner as proposed in Alternative B.

The other five existing WWTPs in the southern part of the project area would be abandoned. They would be replaced with a proposed new regional WWTP at the site in southeast Brownstown Township. Capacity in the RVSDD and DD presently contracted for by various project area communities would be sold to eastern (downstream) communities. Use of the existing Middle Rouge Interceptor in Northville and Plymouth Townships as part of the new regional system would require construction of about 10,000 feet of supplementary sewer in the area of Phoenix Lake to ensure adequate capacity. The same flow and wasteload reduction options assumed in the two previous alternatives (see Section 5.3.1.1.1.) were incorporated into this alternative.

Table 18. Estimated system cost for Alternative B.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor (by segment) | | | |
| North Arm | 17,485 | 8,742 | |
| Hannan Road | 24,239 | 12,112 | |
| Lower Huron | 23,492 | 11,746 | |
| Van Buren-Sumpter Arm (includes Sumpter Connection) | 3,810 | 1,905 | |
| Trenton Arm | 1,382 | 691 | |
| Trenton Pump Station | 1,500 | 300 | 123 |
| B. Treatment | | | |
| 47.4 mgd WWTP | 71,560 | 14,312 | 4,320 |
| 10,000-foot outfall sewer | 5,810 | 2,905 | |
| Total | 149,278 | 52,713 | 4,443 |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 37,320 | | |
| | 186,598 | | |
| D. Interest During Construction (3 years) | 18,543 | | |
| E. Total Capital Cost | 205,141 | | |
| F. Less Present Worth of Salvage Value | -14,612 | | |
| G. Net Capital Cost | 190,529 | | |
| H. Present Worth of O&M | 48,451 | | |
| Total Present Worth | 238,980 | | |
| I. Estimated Total Average Annual Equivalent Cost | 21,914 | | |

J. Cost per 1,000 gallons = $1.27

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[1] Interceptor and outfall sewer unit costs are based on Hubbell, Roth & Clark, Inc. (1976); WWTP costs derived from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment, and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976), adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operational condition.

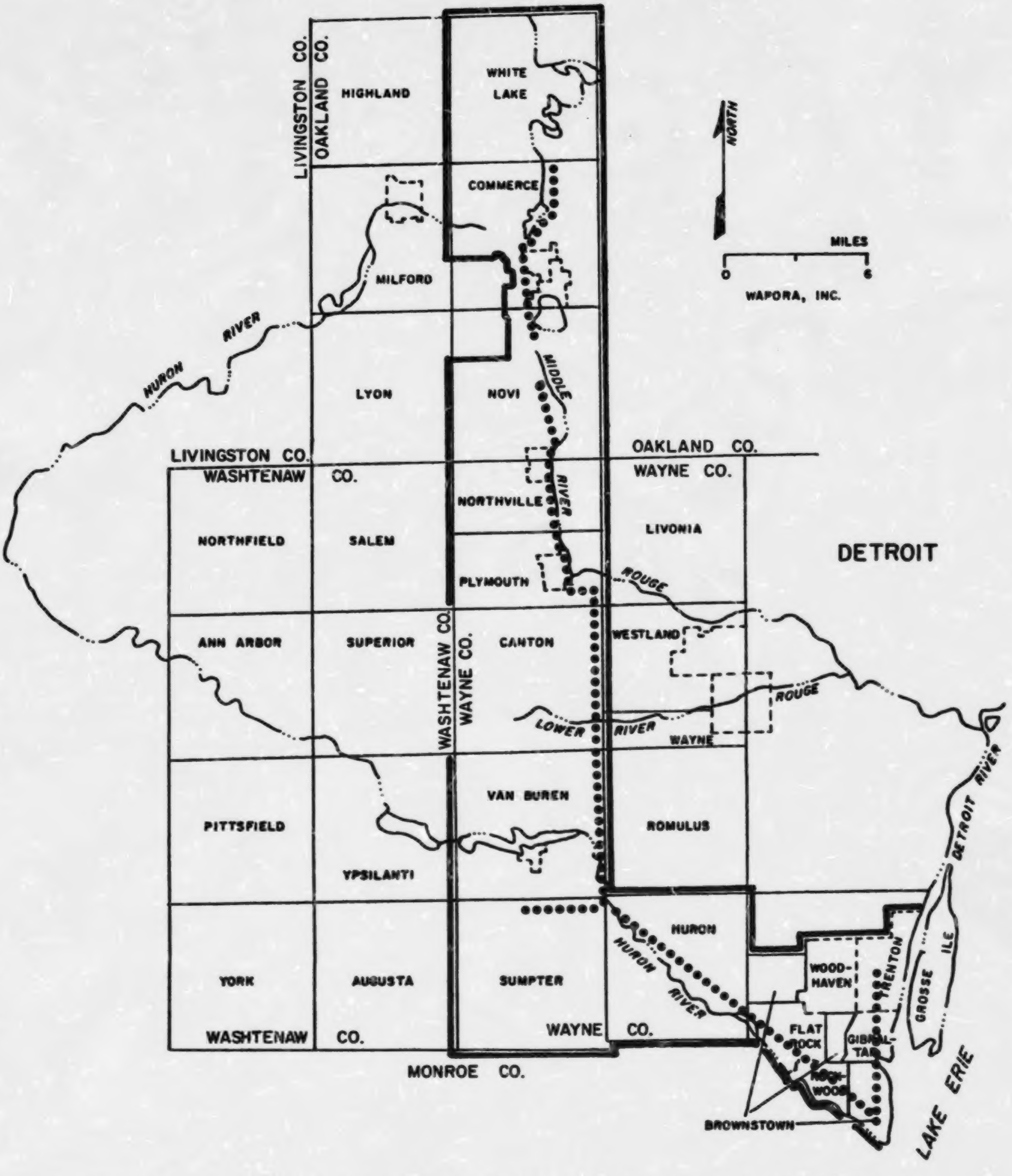
LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
NORTH
MILES
0
6
WAPORA, INC.
COMMERCE
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE RIVER
LIVINGSTON CO.
OAKLAND CO.
WASHTENAW CO.
WAYNE CO.
NORTHVILLE
LIVONIA
DETROIT
NORTHFIELD
SALEM
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
LOWER RIVER ROUGE
WAYNE
DETROIT RIVER
PITTSFIELD
VAN BUREN
ROMULUS
YPSILANTI
HURON
WOOD-HAVEN
TRENTON
GROSSE ILE
YORK
AUGUSTA
SUMPTER
HURON RIVER
FLAT ROCK
GIBRALTAR
WASHTENAW CO.
WAYNE CO.
MONROE CO.
ROCKWOOD
BROWNSTOWN
LAKE ERIE

Figure 10. Alternative C; the conceptual routes of the proposed interceptor sewers are shown by the dotted lines. The Huron Valley project area is delineated by the heavy black line.

The Walled Lake WWTP would be expanded from its existing 1.5 mgd capacity to 4.8 mgd. Treatment process options include expanding the flow equalization, pretreatment, primary sedimentation, and conventional secondary activated sludge systems, and addition of a two-stage lime treatment system to remove as much as 98% of influent phosphorus. The existing tertiary multi-media filtration system also would be expanded. Disinfection would be accomplished by an expanded chlorination system prior to discharge of the effluent to the Walled Lake Branch of the Middle River Rouge. Sludge generated during the treatment process would average about 9 tons per day (dry weight basis), of which 6 tons would be chemical sludge. For purposes of costing, vacuum filtration and incineration were assumed. Land disposal of dewatered sludge, however, may be a viable option at a lower cost if suitable land areas could be located. Ash produced by an incineration process would average 2 tons per day and would require disposal at an unspecified landfill.

The proposed regional WWTP would utilize the same site in Brownstown Township and the same treatment processes and method of effluent disposal as previously discussed. It would have capacity to treat 43 mgd of wastewater and would generate 35 tons of sludge per day. After incineration, about 7 tons per day of ash would remain. The ash would be deposited at an unspecified landfill.

### 5.3.3.2. Construction and Operation Costs

The total estimated construction and operation costs for Alternative C are presented in Table 19. The cost of retiring the remaining debt on the abandoned WWTPs would be approximately $22,000 per year for the next 20 years (Section 5.3.1.1.2.). There would be significant costs for the new local collection systems proposed for areas to be served by this alternative. The amount of such costs is unknown.

## 5.3.4. Alternative D

### 5.3.4.1. Components

Alternative D incorporates the same wastewater management system for the northern communities as presented in Alternative C. The total capacity owned by project area communities in the Middle Rouge Interceptor (37.48 cfs) would continue to be used by Novi, Northville, Northville Township, Plymouth and Plymouth Township. Adequate capacity for projected increases in flow from these communities would be provided by each obtaining a share of the 7.47 cfs capacity owned by Canton Township in the Middle Rouge Interceptor, and through the construction of 10,000 feet of parallel sewer in the Phoenix Lake vicinity to increase the capacity of the existing Middle Rouge Interceptor, as discussed for Alternative C. (The projected 1995 peak flow generated by these communities would require 35.21 cfs of interceptor capacity which is 2.27 cfs less than presently available with Canton Township's share added in.) The Huron Valley Interceptor, therefore, would be needed only as far north as Canton Township (26.4 miles in length, Figure 11) to intercept Canton Township flows and all flows generated in the remainder of the project area to the south. (It may not be cost effective

Table 19. Estimated system cost for Alternative C.

Part 1: Walled Lake System.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor | 9,590 | 4,795 | |
| B. Treatment-4.8 mgd WWTP | 6,746 | 1,349 | 722 |
| Total | 16,336 | 6,144 | 722 |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 4,084 | | |
| | 20,420 | | |
| D. Interest During Construction (2 years) | 1,353 | | |
| E. Total Capital Cost | 21,773 | | |
| F. Less Present Worth of Salvage Value | -1,703 | | |
| G. Net Capital Cost | 20,070 | | |
| H. Present Worth of O&M | 7,873 | | |
| Total Present Worth | 27,943 | | |
| I. Estimated Total Average Annual Equivalent Cost | 2,562 | | |

J. Cost per 1,000 gallons = $1.46

Part 2: Huron Valley Regional System.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor (by segment) | | | |
| North Arm | 854 | 427 | |
| Hannan Road | 21,411 | 10,706 | |
| Lower Huron | 20,963 | 10,481 | |
| Van Buren-Sumpter Arm (includes Sumpter Connection) | 3,810 | 1,905 | |
| Trenton Arm | 1,382 | 691 | |
| Trenton Pump Station | 1,500 | 300 | 123 |
| B. Treatment | | | |
| 43 mgd WWTP | 65,454 | 13,091 | 4,000 |
| 10,000-foot outfall sewer | 5,810 | 2,905 | |
| Total | 121,184 | 40,506 | 4,123 |

Table 19. Estimated system cost for Alternative C (concluded).

Part 2: Huron Valley Regional System (concluded).

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 30,296 | | |
| | 151,480 | | |
| D. Interest During Construction (3 years) | 15,053 | | |
| E. Total Capital Cost | 166,533 | | |
| F. Less Present Worth of Salvage Value | -11,228 | | |
| G. Net Capital Cost | 155,305 | | |
| H. Present Worth of O&M | 44,961 | | |
| Total Present Worth | 200,266 | | |
| I. Estimated Total Average Annual Equivalent Cost | 18,364 | | |

J. Cost per 1,000 gallons = $1.17

Part 3. Summary (Part 1 plus Part 2).

| | Cost in Dollars (x 1,000) |
|---|---|
| A. Total Capital Cost (includes Service Factor and Interest) of System | 188,306 |
| B. Less Present Worth of System Salvage | -12,931 |
| C. Net Capital Cost of System | 175,375 |
| D. Total Present Worth of System O&M | 52,835 |
| E. Total Present Worth of System | 228,210 |
| F. Estimated Total Average Annual Equivalent Cost of System | 20,927 |

G. Overall Cost per 1,000 gallons = $1.20

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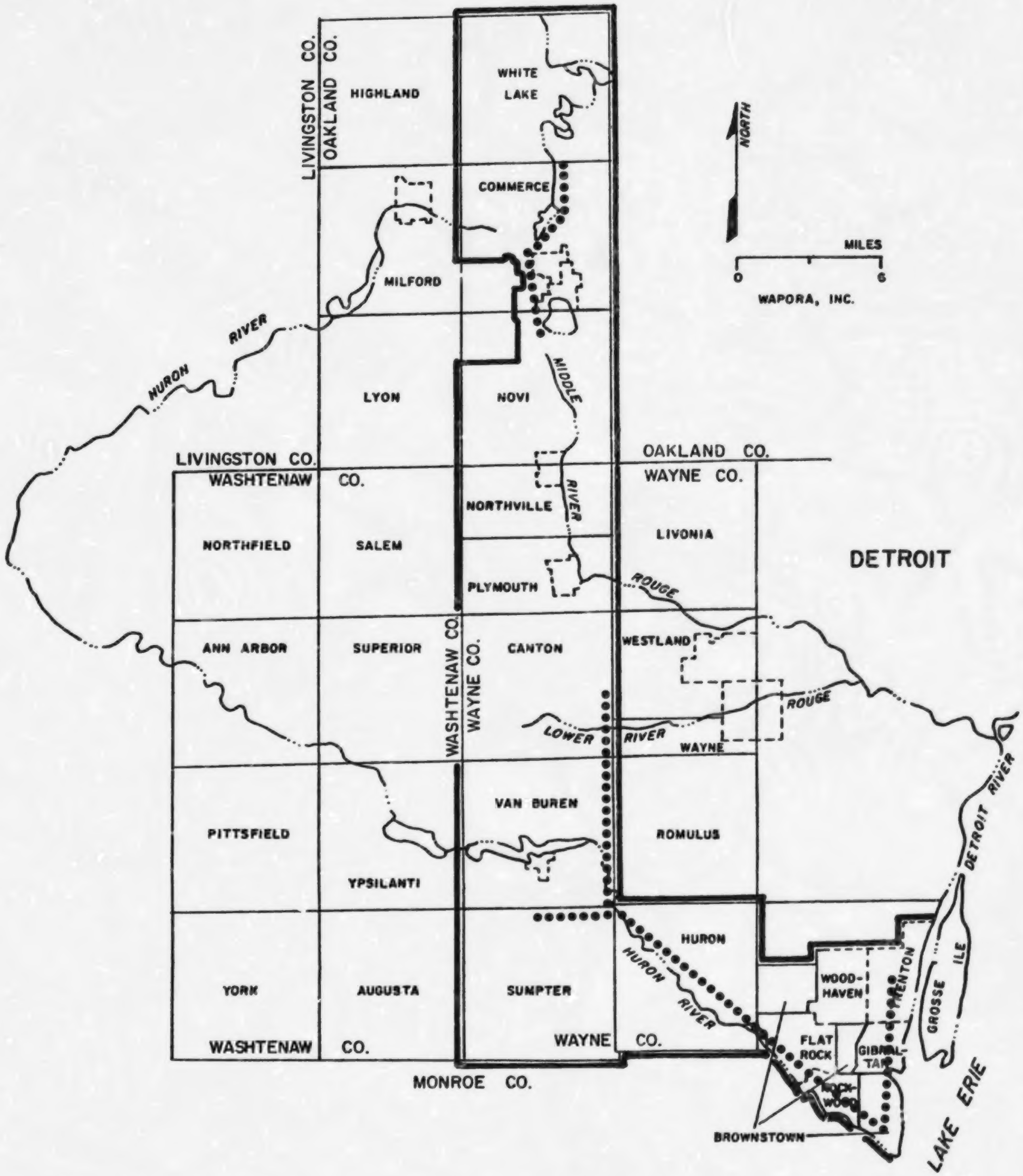
[1] Interceptor and outfall sewer unit costs are based on Hubbell, Roth & Clark, Inc. (1976); WWTP costs deriyed from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment, and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976), adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operational condition.


LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
NORTH
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WAPORA, INC.
COMMERCE
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE RIVER
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
NORTHVILLE
NORTHFIELD
SALEM
LIVONIA
DETROIT
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
ROUGE
LOWER RIVER
WAYNE
DETROIT RIVER
VAN BUREN
PITTSFIELD
ROMULUS
YPSILANTI
HURON
YORK
AUGUSTA
SUMPTER
HURON RIVER
WOOD-HAVEN
TRENTON
GROSSE ILE
FLAT ROCK
GIBRAL-TAR
WASHTENAW CO.
WAYNE CO.
MONROE CO.
ROCK-WOOD
BROWNSTOWN
LAKE ERIE

Figure 11. Alternative D; the conceptual routes of the proposed interceptor sewers are shown by the dotted lines. The Huron Valley project area is delineated by the heavy black line.

to convey flows from northeastern Canton Township to the central part via a new local trunk sewer. In this case, the Hannan Road segment of the interceptor would be needed as far north as Joy Road.) This would allow the 10.1 cfs owned by Canton (6.9 cfs) and Van Buren (3.2 cfs) Townships in the Lower Rouge Interceptor, and the 8.0 cfs of capacity owned by Van Buren Township (5.2 cfs) and Belleville (2.8 cfs) in the Downriver Interceptor to be sold to eastern (downstream) communities in the RVSDD and DD.

Alternative D would serve the same sewered-area population as Alternatives B and C. The flow reduction option of reducing I/I where cost-effective and the industrial pretreatment option to reduce wasteloads have been assumed. The interceptor route, regional plant site, treatment processes, and methods of effluent and sludge disposal are the same as described for previous alternatives. The five existing WWTPs in the southeast part of the project area would be abandoned and replaced by the new regional WWTP.

The regional system serving the southern half of the project area would require a 32 mgd plant. Total sludge production is estimated to be 26 tons per day (dry weight basis). After incineration, 5 tons per day of ash would require disposal. A landfill site has not been specified. The 4.8 mgd Walled Lake WWTP, as discussed for Alternative C, would generate 9 tons per day of sludge, which would result in about 2 tons per day of ash if incineration is used.

### 5.3.4.2. Construction and Operation Costs

Total new construction and operation cost estimates for Alternative D are presented in Table 20. The costs for the northern interceptor system and for expanding and upgrading the Walled Lake WWTP (Table 19) are summarized in Table 20. Other costs, such as the continued utilization of the RVSDD, must be considered to ensure an equitable comparison among alternatives. They are presented below:

| | Average Annual Cost ($ x 1,000) |
|---|---|
| (1) Continued use of RVSDD | |
| -Cost of treating an average 9.1 mgd at the Detroit WWTP | 1,036 |
| -Principal and interest share for continued use of Middle Rouge Interceptor and abandonment of Canton-Van Buren Township share in Lower Rouge Interceptor | 101 |
| (2) Cost of abandoning 5 WWTPs (see Section 5.3.1.1.2. for details) | 22 |
| (3) New local collection sewers | Unknown |
| | 1,159 |

Table 20. Estimated system cost for Alternative D.

Part 1. Walled Lake System (Table 19).

Part 2. Huron Valley Regional System.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Interceptor (by segment) | | | |
| Middle Rouge Supplement | 854 | 427 | |
| Hannan Road | 14,981[4] | 7,490[4] | |
| Lower Huron | 18,356 | 9,178 | |
| Van Buren-Sumpter Arm (includes Sumpter Connection) | 3,810 | 1,905 | |
| Trenton Arm | 1,382 | 691 | |
| Trenton Pump Station | 1,500 | 300 | 123 |
| B. Treatment | | | |
| 32 mgd WWTP | 49,183 | 9,837 | 3,190 |
| 10,000-foot outfall sewer | 5,810 | 2,905 | |
| Total | 95,876 | 32,733 | 3,313 |
| C. Service Factor (25%) - Engineering, Administrative, Legal, and Contingencies | 23,969 | | |
| | 119,845 | | |
| D. Interest During Construction (3 years) | 11,910 | | |
| E. Total Capital Cost | 131,755 | | |
| F. Less Present Worth of Salvage Value | -9,074 | | |
| G. Net Capital Cost | 122,681 | | |
| H. Present Worth of O&M | 36,128 | | |
| Total Present Worth | 158,809 | | |
| I. Estimated Total Average Annual Equivalent Cost | 14,563 | | |

J. Cost per 1,000 gallons = $1.25

Part 3. Summary (Part 1 plus Part 2).

| | Cost in Dollars (x 1,000) |
|---|---|
| A. Total Capital Cost (includes Service Factor and Interest) of System | 153,528 |
| B. Less Present Worth of System Salvage | -10,777 |
| C. Net Capital Cost of System | 142,751 |

Table 20. Estimated system cost for Alternative D (concluded).

Part 3. Summary (concluded).

| | | Cost in Dollars (x 1,000) |
|---|---|---|
| D. | Total Present Worth of System O&M | 44,001 |
| E. | Total Present Worth of System | 186,752 |
| F. | Estimated Total Average Annual Equivalent Cost of System | 17,125 |
| G. | Overall Cost per 1,000 gallons = $1.27 | |

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[1] Interceptor and outfall sewer unit costs are based on Hubbell, Roth & Clark, Inc. (1976); WWTP costs derived from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment, and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976), adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operational condition.

[4] Does not include cost of extending interceptor 3.0 miles to Joy Road as discussed in Section 5.3.4.1.

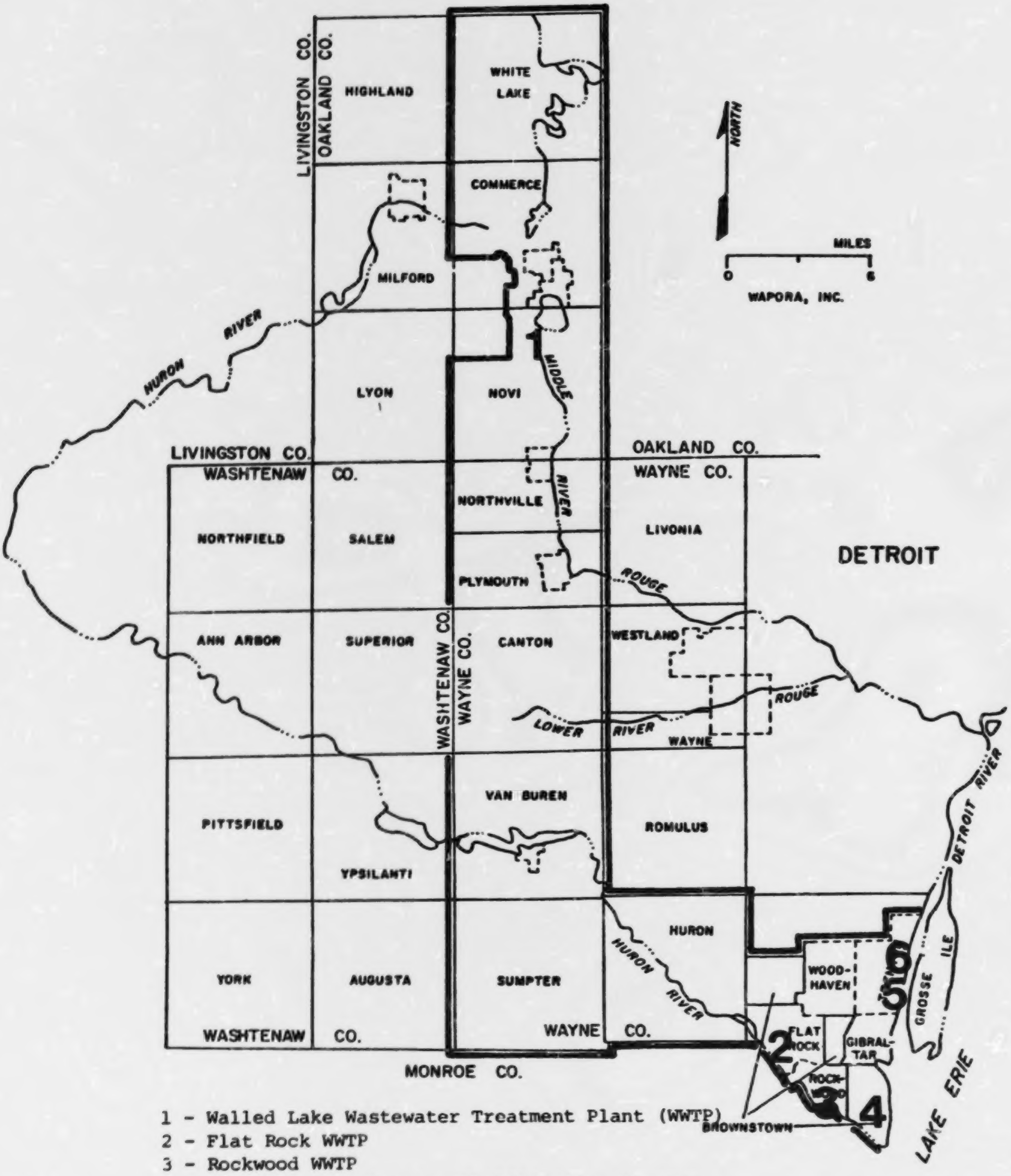
## 5.3.5. Alternative E

### 5.3.5.1. Components

This alternative includes upgrading and expanding the five existing WWTPs in the southeast part of the project area and the continued operation of the existing Walled Lake WWTP (Figure 12). The projected 1995 population served by these systems is shown in Table 21. No new interceptors would be constructed. The capacities contracted in the Rouge Valley Sewage Disposal District (RVSDD) and Downriver District (DD) by the Cities of Novi, Plymouth, Northville, and Belleville, and the Townships of Northville, Plymouth, Canton, and Van Buren would continue to be utilized. Growth in areas of these communities which are not sewered presently would be limited. Only growth which would be accommodated through the implementation of system flow reducing measures (such as I/I reduction or flow equalization) could be provided service. Continued reliance on septic disposal systems would allow some growth. Alternative E offers no wastewater disposal solution for Sumpter, Commerce, or White Lake Townships; instead, these communities would continue to rely on septic disposal systems or on some other local solution. Thus, this alternative would not provide public wastewater treatment for the projected 1995 project area population.

With the removal of cost-effective I/I from existing collection systems, increased flows generated by some new sewer service in the communities served by the RVSDD and DD could be accommodated. Table 22 compares estimated existing flows in these communities with estimated flows by the year 1995--once cost-effectively removable I/I has been eliminated. This, in turn, is compared with the existing contract capacities. The final column indicates the amount of additional peak capacity in an interceptor system which would be needed if those residents which were projected to have sewer service in Alternatives B, C, and D also were served under this alternative. If flow equalization basins were constructed by these communities, the projected sewered population served in the other alternatives could probably be served until 1995. This only would provide an interim solution. In addition, Sumpter, Commerce, and White Lake Townships still would not have access to a treatment system. It is probable that implementation of Alternative E would result in the eventual need for and construction of an undetermined number of additional small, local WWTPs. These facilities would be needed to alleviate existing and future wastewater management problems in sections of the project area not served by Alternative E, especially Sumpter Township.

To meet the needs of projected growth in existing service areas and the treatment plant effluent requirements (Section 5.2.4.), the five existing WWTPs serving the southeastern part of the project area would require expansion and upgrading. The treatment processes selected for each were discussed in Section 5.2.3. A comparison between the existing WWTP size and the projected expanded size is shown in Table 23. Additional land required for plant expansion also is shown. The Walled Lake WWTP is projected to have adequate capacity to meet the needs of its service area through 1995.


LIVINGSTON CO.
OAKLAND CO.
HIGHLAND
WHITE LAKE
NORTH
COMMERCE
MILES
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WAPORA, INC.
MILFORD
HURON RIVER
LYON
NOVI
MIDDLE RIVER
LIVINGSTON CO.
WASHTENAW CO.
OAKLAND CO.
WAYNE CO.
NORTHVILLE
NORTHFIELD
SALEM
LIVONIA
DETROIT
PLYMOUTH
ROUGE
ANN ARBOR
SUPERIOR
WASHTENAW CO.
WAYNE CO.
CANTON
WESTLAND
LOWER RIVER
ROUGE
WAYNE
PITTSFIELD
YPSILANTI
VAN BUREN
ROMULUS
DETROIT RIVER
YORK
AUGUSTA
SUMPTER
HURON
HURON RIVER
WOOD-HAVEN
GROSSE ILE
WASHTENAW CO.
WAYNE CO.
FLAT ROCK
GIBRAL-TAR
ROCK-WOOD
MONROE CO.
BROWNSTOWN
LAKE ERIE
1
2
3
4
5
6

1 - Walled Lake Wastewater Treatment Plant (WWTP)
2 - Flat Rock WWTP
3 - Rockwood WWTP
4 - Brownstown Wastewater Stabilization Lagoons
5 - City of Trenton WWTP
6 - Wayne County Trenton WWTP

Figure 12. Alternative E; locations of existing wastewater treatment facilities are indicated by numbers 1 through 6. The Huron Valley project area is delineated by the heavy black line.

Table 21. Estimated 1995 population served by expanded and upgraded existing project area wastewater treatment plants.

| Wastewater Treatment Plant | Estimated 1995 Population Served |
|---|---|
| Flat Rock[1] | 31,200 |
| Rockwood[2] | 6,400 |
| Wayne County-Trenton[3] | 41,050 |
| City of Trenton | 22,150 |
| Brownstown Township[4] | 6,800 |
| Walled Lake[5] | 7,900 |
| Total | 115,500 |

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[1] Includes service for Huron Township.

[2] Includes service for South Rockwood.

[3] Includes service for central Brownstown Township, Woodhaven, and Gibraltar.

[4] Includes service only for southeast Brownstown Township.

[5] Includes service for northern Novi.

Table 22. Potential future flows from project area communities to the Rouge Valley Sewage Disposal District and the Downriver District.

| Community | Estimated 1976 Peak Flow[1] (cfs) | Projected 1995 Peak Flow[2] (cfs) | Contract Capacity (cfs) | Additional Capacity Needed (cfs) |
|---|---|---|---|---|
| A. Rouge Valley District | | | | |
| Novi | 3.08 | 6.40 | 4.00 | 0.0[3] |
| Northville | 4.47 | 2.36 | 3.60 | 0.0 |
| Northville Twp. (includes Institutions) | 7.37 | 11.04 | 8.01[4] | 3.03 |
| Plymouth | 7.15 | 4.98 | 4.80 | 0.18 |
| Plymouth Twp. | 14.26 | 11.57 | 9.60 | 1.97 |
| Canton Twp. | 13.31 | 24.16 | 14.37 | 9.79 |
| Van Buren Twp. (northern one-third) | 0.57 | 3.24 | 3.20 | 0.04 |
| Total | 50.21 | 63.75 | 47.58 | 15.01 |
| B. Downriver District | | | | |
| Belleville | 2.03 | 1.90 | 2.8 | 0.0 |
| Van Buren Twp. (remainder) | 3.87 | 14.36 | 5.2 | 9.16 |
| Total | 5.90 | 16.26 | 8.0 | 9.16 |

---

cfs = cubic feet per second
Twp. = Township

[1] See Section 3.4.2.

[2] Assumes cost-effective I/I will be removed and projected increases in sewered population

[3] Novi already utilizes flow equalization which is assumed to be capable of "smoothing" projected 1995 flow of 6.4 cfs to 4.0 cfs.

[4] Includes 5.41 cfs owned by public institutions.

Table 23. Existing and projected capacities of the six project area WWTPs.

| WWTP | Existing Capacity (mgd) | Required Capacity (mgd) | Required Type of Treatment | Approximate Land Area Required (acres) |
|---|---|---|---|---|
| Flat Rock | 1.0 | 4.6 | Tertiary | 5.0[1] |
| Rockwood[2] | 1.0 | 0.8 | Tertiary | 0.0 |
| City of Trenton | 3.6 (primary)<br>5.5 (secondary) | 5.5 | Secondary | 0.0 |
| Wayne County-Trenton | 2.4 (primary only) | 6.1 | Secondary | 0.0 |
| Southeast Brownstown | 0.18 (lagoons) | 0.9 | Tertiary | 0.0 |
| Walled Lake | 1.5 | 0.8 | Tertiary | 0.0 |

---

WWTP = Wastewater treatment plant
mgd = millions of gallons per day

[1] The existing Flat Rock WWTP is surrounded by developed residential property and the Huron River floodplain, which would make expansion difficult.

[2] Includes South Rockwood.

Sludge production at each of the plants is projected to be:

| WWTP | Tons/Day (Dry Weight) |
|---|---|
| Walled Lake | 1 |
| Flat Rock | 4 |
| Rockwood | 1 |
| Wayne County-Trenton | 6 |
| City of Trenton | 6 |
| Brownstown Township | 1 |

Sludge processing and disposal methods would vary. The Walled Lake WWTP would continue to use aerobic digestion, sludge drying beds, and final disposal on land as soil conditioner. The expanded Flat Rock WWTP could use its own incineration, as costed, or possibly continue to transport its sludge to the Wyandotte WWTP for dewatering and incineration. This would depend on Wayne County-Trenton incinerating its own sludge instead of transporting it to Wyandotte. Ash production from incinerated sludge from the Flat Rock WWTP would average less then 1.0 ton per day, and just over 1.0 ton per day from the Wayne County-Trenton WWTP. Sludge from the Rockwood WWTP could continue to be incinerated at the Wyandotte WWTP, resulting in an average of several hundred pounds of ash per day. Continued incineration of sludge from the City of Trenton WWTP would continue to generate an average of more than 1.0 ton of ash per day. Sludge from the aerobic digestion process at the new Brownstown Township WWTP could be disposed of at a landfill. Alternatively the sludge could be dewatered on sand beds with disposal at a landfill.

### 5.3.5.2. Construction and Operation Costs

The new construction and operation costs for upgrading and expanding the six WWTPs are shown in Table 24. Because these costs only reflect continued wastewater disposal for project area communities in the service areas of these six WWTPs, costs for continued disposal in other communities also must be addressed. This includes the costs incurred by communities continuing to utilize the RVSDD, DD and septic tanks. These costs are as follows:

| | Average Annual Cost ($ x 1,000) |
|---|---|
| (1) Continued use of RVSDD | |
| -Treatment of an average 12.3 mgd at the Detroit WWTP | 1,400 |
| -Principal and Interest on 47.58 cfs capacity in RVSDD | 101 |
| (2) Continued use of DD | |
| -Treatment of an average 2.0 mgd at the Wyandotte WWTP | 255 |
| -Principal and Interest on 8.0 cfs capacity in DD | 33 |
| (3) Estimated cost for flow equalization in RVSDD and DD | |
| -Northville Township ($380,000 for 25 years at 7.5%) | 34 |

|  |  | Average Annual Cost ($ x 1,000) |
|---|---|---|
|  | -Plymouth ($260,000 for 25 years at 7.5%) | 23 |
|  | -Plymouth Township ($400,000 for 25 years at 7.5%) | 36 |
|  | -Canton Township ($560,000 for 25 years at 7.5%) | 50 |
|  | -Van Buren Township ($460,000 for 25 years at 7.5%) | 41 |
| (4) | Estimated cost for new septic tanks | 663 |
| (5) | Estimated maintenance cost for septic tanks (Existing and new which would be replaced by sewers in other alternatives) | 1,183 |
| (6) | New local collection sewers for expansion of existing sewer service areas | Unknown |
|  | Total | 3,819 |

Table 24. Estimated system cost for Alternative E.

| | Cost in Dollars (x 1,000) | | |
|---|---|---|---|
| | Capital[1] | Salvage[2] | Average Annual O&M[3] |
| A. Wastewater Treatment Plant | | | |
| Flat Rock | 10,200 | 2,000 | 665 |
| Rockwood | 205 | 41 | 200 |
| City of Trenton | 190 | 38 | 840 |
| Wayne County-Trenton | 12,645 | 2,529 | 838 |
| Brownstown Township | 2,114 | 423 | 200 |
| Walled Lake | 0 | 0 | 200 |
| Total | 25,354 | 5,031 | 2,943 |
| B. Interest During Construction (2 years) | 1,680 | | |
| C. Total Capital Cost | 27,034 | | |
| D. Less Present Worth of Salvage Value | -1,395 | | |
| E. Net Capital Cost | 25,639 | | |
| F. Present Worth of O&M | 32,093 | | |
| Total Present Worth | 57,732 | | |
| G. Estimated Total Average Annual Equivalent Cost | 5,294 | | |

H. Cost per 1,000 gallons = $0.78

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[1] Includes Service Factor; WWTP costs derived from US-EPA (1978).

[2] Assumes 40-year life for interceptor and structures, 20-year life on equipment, and straight-line depreciation.

[3] Based on cost information in Hubbell, Roth & Clark, Inc. (1976), adjusted to January 1978 price levels. 1985 flow estimates were utilized to provide an average operation condition.

## 6.0. IMPACTS OF ALTERNATIVES

The following sections discuss the potential major impacts associated with the system alternatives described in Section 5.3. Primary impacts resulting from construction (Section 6.1.) and operation (Section 6.3.) of facilities are presented. Secondary impacts, those effects induced or created indirectly by the implementation of an alternative, are discussed in Section 6.3. Many of the potentially adverse impacts may be reduced or eliminated by various techniques discussed in Section 6.4.

### 6.1. Construction Impacts

### 6.1.1. Impacts on the Natural and Man-Made Environment

The construction of a regional interceptor sewer and WWTP in the project area as proposed in Alternatives A through D or expansion of existing WWTPs as proposed in Alternative E would affect various aspects of the existing environmental setting to different degrees. The excavation of trenches and tunneling for the interceptors proposed in Alternatives A through D would produce the most significant primary impacts. They include: generation of fugitive dust and noise, destruction of vegetation, disturbance of wetlands and animals, increased sediment loads to watercourses, groundwater drawdowns, temporary interruption of transportation routes, and impairment of aesthetics along the proposed interceptor corridor. The project would entail the commitment of significant quantities of resources, including public sector capital, energy, land, and materials. A significant number of new construction jobs would be created.

Major primary construction impacts at the new regional WWTP site in Brownstown Township (proposed in Alternatives A through D), at the expanded Walled Lake WWTP (proposed in Alternatives C and D), or at the sites of the five existing WWTPs (Alternative E) would be similar. They include production of fugitive dust and noise; increased sediment loads to watercourses; localized impairment of aesthetics; commitment of significant amounts of capital, energy, and materials; and creation of new construction oriented jobs.

The physical, biological, and social impacts of the system alternatives are compared in Table 25. The effects are quantified where possible. The finanacial impact of each system alternative is presented separately in the following section.

### 6.1.2. Impacts on Local Public Finance

Twenty percent of the total project capital cost must be funded by local participants. This cost would be allocated based on the proportion of interceptor system and treatment plant capacity utilized by or reserved by each community.

Estimated allocations of total local capital costs among the communities which would participate in each alternative are presented in the first column of Tables 26 through 31. The second column indicates the estimated equivalent average annual cost to each community assuming that Wayne County would secure

Table 25. Potential major primary impacts from construction of the Huron Valley Wastewater Control System, Michigan.

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 1) Air Quality and Odors | a) Nuisance fugitive dust would be generated from:<br>• 44.9 miles of interceptor trenching<br>• clearing sixty 1- to 2-acre tunnel access areas<br>• clearing 40- to 50-acre WWTP site<br>• unpaved construction access roads. | a) Same as A-1. | a) Nuisance fugitive dust would be generated from:<br>• 48.4 miles of interceptor trenching<br>• clearing sixty 1- to 2-acre tunnel access areas<br>• clearing 40- to 50-acre WWTP site<br>• unpaved construction access roads. | a) Nuisance fugitive dust would be generated from:<br>• 45.3 miles of interceptor trenching<br>• clearing fifty 1- to 2-acre tunnel access areas<br>• clearing 40- to 50-acre WWTP site<br>• unpaved construction access roads. | a) Nuisance fugitive dust would be generated from:<br>• 45.3 miles of interceptor trenching<br>• clearing forty-two 1- to 2-acre tunnel access areas<br>• clearing 40- to 50-acre WWTP site<br>• unpaved construction access roads. | a) Nuisance fugitive dust would be generated and hydrocarbons and fumes would be emitted from construction equipment at each of five existing WWTP sites. Two of these sites (Flat Rock and Rockwood) are in residential areas. |
| | b) Emission of hydrocarbons and fumes from construction equipment occasionally may be locally objectionable. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | |
| 2) Noise | a) Drilling, excavating, and other equipment noise generated from construction activities in areas noted in 1) above would be discernible up to 2,000 feet from sites:<br>• noise at 500 feet from tunnel access points would vary from 67 dBA to negligible levels as tunneling proceeded underground<br>• noise of greater intensity may be released periodically at access points if underground blasting is required<br>• surface sewer trenching noise would average 64 dBA at 500 feet<br>• construction noise at WWTP site would average 62 dBA at 1,000 feet (negligible relative to measured background). | a) Same as A-1. | a) Same as A-1, but applicable to areas in a) above. | a) Same as A-1, but applicable to areas in a) above. | a) Same as A-1, but applicable to areas in a) above. | a) Noise from expansion of five WWTPs would average 62 dBA at 1,000 feet. Close proximity of construction noise at Flat Rock and Rockwood sites to residential areas could create a nuisance. |
| | | | | b) Noise from expansion of Walled Lake WWTP would average 62 dBA at 1.000 feet. | b) Same as C. | |
| 3) Geology, Soils, and Topography | a) Disposal of any excess excavation spoil and an estimated 1.9 million cubic feet of tunnel spoil could alter topography to a limited extent at disposal sites. | a) Same as A-1. | a) Same as A-1, except that an estimated 2.6 million cubic feet of tunnel spoil would require disposal (37% more than A-1 or A-2). | a) Same as A-1, except that 2.0 million cubic feet of tunnel spoil would require disposal (5% more than A-1 and A-2, 23% less than B). | a) Same as A-1, except that 1.4 million cubic feet of tunnel spoil would require disposal (26% less than A-1 and A-2, 46% less than B, and 30% less than C). | No significant impacts are expected. |
| | b) Trenching would alter soil regime and topography to a limited extent along interceptor right-of-way. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | |
| | c) Excavating in wetlands could release odors from exposure of organic soils. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | |

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Table 25. Potential major primary impacts from construction of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 4) Vegetation | a) Trenching 33.0 miles of mainstem interceptor would disturb up to 400 acres (100-foot right-of-way), including the following important land cover types:<br>Type of Land Cover — Acres<br>Active cropland 4.8<br>Vacant brushland and grassland 31.5<br>Vacant open and wooded wetlands 66.7<br>Recreational brushland and grassland 15.8<br>Recreational wooded and open wetlands 65.5<br>Unvegetated recreational land. 14.5 | a) Same as A-1. | a) Trenching 36.5 miles of mainstem interceptor would disturb up to 442 acres. including the following important land cover types:<br>Type of Land Cover — Acres<br>Active cropland 9.7<br>Vacant brushland and grassland 31.5<br>Vacant open and wooded wetlands 70.3<br>Recreational brushland and grassland 26.7<br>Recreational wooded and open wetlands 71.5<br>Unvegetated recreational land. 24.2 | a) Trenching 33.4 miles of mainstem interceptor would disturb up to 405 acres including the following important land cover types:<br>Type of Land Cover — Acres<br>Active cropland 9.7<br>Vacant brushland and grassland 31.5<br>Vacant open and wooded wetlands 63.0<br>Recreational brushland and grassland 15.8<br>Recreational wooded and open wetlands 60.6<br>Unvegetated recreational land. 9.7 | a) Same as C. | No significant impacts are expected. |
| | b) An additional 144 acres of undefined land cover could be disturbed for the right-of-way of the 4.8-mile Trenton Arm and for the 7.1-mile Van Buren-Sumpter Arm of the interceptor; 60 to 120 acres could be disturbed for the tunnel access areas; and 40 to 50 acres could be disturbed for the WWTP site. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1, except that 10 to 20 fewer acres would be affected because there would be ten fewer tunnel access sites. | b) Same as A-1, except that 18 to 36 fewer acres would be affected because there would be eighteen fewer tunnel access sites. | |
| | c) Dewatering of trenches and tunnels during construction temporarily would lower local water tables, affecting adjacent vegetation--especially in wetlands. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | |
| | d) Although the interceptor corridor contains general habitat requirements for 5 of the 12 plant species considered imperiled in Michigan, none are known to exist in the corridor. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | |
| | | | | e) A small amount of vacant land at the Walled Lake WWTP site would be cleared for expansion of the plant. | e) Same as C. | |
| 5) Animals | a) Noise and construction activity temporarily may drive birds and other wildlife from areas adjacent to the construction site, resulting in short-term overcrowding, increased competition, and the potential for increased mortality. The greatest impact would likely occur in the lake regions in Commerce Township, and along the Middle Rouge and Huron Rivers. A total of 1.9 miles of wooded wetland habitat type (not extensive in the project area) would be crossed. | a) Same as A-1. | a) Same as A-1, except that 2.1 miles of the wooded wetland habitat type would be crossed by the interceptor. | a) Same as B. | a) Same as B. | No significant impacts are expected. |
| | b) Wildlife would be displaced permanently by construction of the regional WWTP. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | |
| | c) No state or federally designated endangered species are expected to be affected. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | |

Table 25. Potential major primary impacts from construction of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 6) Wetlands | a) Proposed mainstem interceptor would transect or be adjacent to about 10.9 miles of open or wooded wetlands. Wetlands subjected to trenching or tunnel access would be impacted significantly:<br>● natural cover would be removed and some habitat could be destroyed permanently<br>● internal drainage patterns may be interrupted and/or changed permanently, which could kill vegetation through ponding or desiccation<br>● increased sedimentation could result from erosion of excavation soils. | a) Same as A-1 | a) Same as A-1, except that about 11.2 miles of open or wooded wetlands would be crossed or would be adjacent to the proposed mainstem interceptor. | a) Same as B. | a) Same as B. | No significant impacts are expected. |
| | b) Dewatering trenches and tunnels during construction would temporarily lower adjacent groundwater levels, potentially killing vegetation by desiccation. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | |
| | c) Potential wetland habitat for State-designated imperiled species, including the smallmouth salamander, marsh hawk, and southern bog lemming may be disturbed. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | |
| 7) Surface Water | a) Twenty-nine river and drainageway crossings by the mainstem interceptor, two crossings by the Trenton Arm, and eight by the Van Buren-Sumpter Arm would cause significant short-term increases in turbidity and sedimentation downstream and/or interruption of flow, resulting in reduced water quality and the potential for adverse impact to aquatic biota. | a) Same as A-1. | a) Same as A-1, with an additional crossing of the Huron River northeast of the Village of Commerce, and the crossing of a minor drainageway in the same area. | a) Same as B. | a) Same as B. | a) No river or drainageway crossings are anticipated. |
| | b) If not properly mitigated, surface runoff from disturbed areas and discharge of turbid waters pumped from excavations could contribute to increased turbidity and sedimentation in waterways. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Potential would exist for surface runoff from excavated areas during construction at five WWTP sites. If not properly mitigated this would contribute increased solids (turbidity) to receiving waters. |
| | c) Waterford Pond, Phoenix Lake, Wilcox Lake, and Newburgh Lake on the Middle River Rouge; the Flat Rock impoundment on the lower Huron River; and the western-shore area of Lake Erie downstream from the mouth of the Huron River would function as sediment traps, with a resultant increase in turbidity and sedimentation from increased solids contributions upstream. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Increased solids loadings due to erosion at construction sites would cause minimal increases in turbidity and sedimentation in the western-shore area of Lake Erie, downstream from the mouths of the Trenton Channel and Huron River. |

**Table 25. Potential major primary impacts from construction of the HVWWCS (continued).**

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 8) Groundwater | a) Dewatering of excavations and tunnels would reduce local groundwater levels during construction up to 2,000 feet from the interceptor right-of-way (ROW). Local, shallow wells adjacent to the ROW temporarily could be dewatered, especially in the soils in the northern part of the project area. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | No significant impacts are expected. |
| 9) Demographics and Economics | a) An estimated 1,250 construction-related jobs would be created during three construction seasons. | a) An estimated 1,000 construction-related jobs would be created during three construction seasons. | a) An estimated 1,200 construction-related jobs would be created during three construction seasons. | a) An estimated 975 construction-related jobs would be created in Wayne County during three construction seasons for the regional wastewater control system. An additional 200 construction jobs would be created in southern Oakland County during two seasons for construction of the expanded Walled Lake System | a) An estimated 775 construction-related jobs would be created in Wayne County during three construction seasons for the regional wastewater control system. An additional 200 construction jobs would be created in southern Oakland County during two seasons for construction of the expanded Walled Lake System. | a) An estimated 250 construction-related jobs would be created by construction at the five WWTPs during two construction seasons. |
|  | b) The expenditure of an estimated $207 million for system construction would generate considerable amounts of short-term indirect and induced employment in other economic sectors in the southeast Michigan region, and at the sites where materials for system construction are manufactured. | b) Same as in A-1, but capital expenditure would be an estimated $168.8 million. | b) Same as in A-1, but capital expenditure would be an estimated $205.1 million. | b) Same as A-1, but capital expenditure would be an estimated $188.3 million. | b) Same as A-1, but capital expenditure would be an estimated $153.5 million. | b) Same as A-1, but estimated total capital expenditure would be $27 million (about 13% of A-1 and 18% of D). |
|  | c) Few, if any, residents would be displaced by construction activities. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) An unknown number of residents would be displaced to accommodate construction of the expanded Flat Rock WWTP. |
| 10) Land Use | a) Utilization of parks temporarily would be disrupted by interceptor construction in parklands. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Parks would not be affected directly. |
|  | b) The regional WWTP site is located within the estimated 100-year maximum lake-level plain for Lake Erie. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) The Flat Rock and Rockwood WWTP sites are within a flood hazard area adjacent to the Huron River. The Brownstown Township WWTP site is in the estimated 100-year maximum lake-level plain for Lake Erie. |
|  | c) Construction of the regional WWTP permanently would alter existing land uses at the proposed Brownstown Township WWTP site and adjacent properties. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Up to 5 acres of residentially developed property adjacent to the Flat Rock WWTP would be converted for the expanded WWTP. Expansion at the other four WWTP sites would be on existing WWTP property (permanent uses of adjacent land at the Trenton and W.C.-Trenton WWTPs preclude their expansion outside existing property). |

Table 25. Potential major primary impacts from construction of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 11) Transportation | a) Vehicular traffic flow would be interrupted temporarily where the interceptor is routed across or adjacent to streets and roads (6 Mile, 5 Mile, Waltz, Fort, and River Roads may be crossed by open-cut sewer emplacement, and Jefferson Avenue, Streicher Road, Huron River Drive, Sumpter Road, Hannan Road, Middle Rouge Parkway, and Benstein Road also would be affected to varying degrees). Minimal disruption of public services such as police, fire, and ambulance could occur. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Heavy equipment traffic at five WWTP construction sites may cause traffic congestion. Some interference of prompt public service could result. |
| | b) Access to homes and businesses may be interrupted temporarily by interceptor construction. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Temporary access limitations would be localized. |
| | c) Increased heavy equipment traffic resulting from construction activities (including spoil disposal) would create a short-term increase in traffic congestion and possible hazardous situations, and may damage roadway surfaces in the project area. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1, except that the potential impacts would be localized. |
| 12) Cultural, Historic, and Archaeological Resources | a) No historic or archaeological sites are known to exist at the proposed Brownstown Township WWTP site. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) There are no known sites in areas to be affected by excavations for expansion of the five WWTPs. |
| | b) Minimal potential exists that any historic or cultural site located adjacent to the interceptor right-of-way may be damaged by vibrations. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) No interceptor construction is included in the alternative. |
| | c) It is possible that significant archaeological sites exist in the project area and could be damaged by construction activities. Conversely, it is possible that construction excavation may uncover important sites which otherwise would not be found. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1, except that potential impacts would be localized. |
| 13) Resource Use | a) There would be an irretrievable commitment of $207 million of public capital. | a) There would be an irretrievable commitment of $168.8 million of public capital. | a) There would be an irretrievable commitment of $205.1 million of public capital. | a) There would be an irretrievable commitment of $188.3 million of public capital. | a) There would be an irretrievable commitment of $153.5 million of public capital. | a) There would be an irretrievable commitment of $27 million of public capital. |
| | b) A presently undetermined amount of engineering, administrative, legal, construction (see 9 above), and other labor has been/will be committed to the project. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. |

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Table 25. Potential major primary impacts from construction of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 13) Resource Use (continued) | c) Energy and material resources would be committed irretrievably to the construction of:<br>● 44.9 miles of open-trench interceptor<br>● 22.3 miles of tunnel interceptor<br>● 49.2 mgd WWTP<br>● 10,000-foot outfall sewer. | c) Same as A-1, except that the capacity of the WWTP would be 37.0 mgd. | c) Energy and material resources would be committed irretrievably to the construction of:<br>● 48.4 miles of open-trench interceptor<br>● 22.3 miles of tunnel interceptor<br>● 47.4 mgd WWTP<br>● 10,000-foot outfall sewer. | c) Energy and material resources would be committed irretrievably to the construction of:<br>● 45.3 miles of open-trench interceptor<br>● 19.2 miles of tunnel interceptor<br>● 43.0 and 4.8 mgd WWTPs<br>● 10,000-foot outfall sewer. | c) Energy and material resources would be committed irretrievably to the construction of:<br>● 45.3 miles of open-trench interceptor<br>● 16.2 miles of tunnel interceptor<br>● 32.0 and 4.8 mgd WWTPs<br>● 10,000-foot outfall sewer. | c) Energy and material resources would be committed irretrievably to the construction of:<br>● new 4.6 mgd tertiary WWTP at Flat Rock<br>● 0.8 mgd primary addition to Rockwood WWTP<br>● 3 mgd primary addition to Trenton WWTP<br>● new 6.1 mgd secondary WWTP at W.C.-Trenton WWTP site<br>● new 0.9 mgd tertiary WWTP at Brownstown Township WWTP site. |
| | d) About 1,000 acres of land utilized for interceptor right-of-way and for the regional WWTP site would be committed at least for the useful life of the facilities (estimated at 50 years). | d) Same as A-1. | d) About 1,050 acres of land utilized for interceptor right-of-way and for the regional WWTP site would be committed at least for the useful life of the facilities (estimated at 50 years). | d) About 960 acres of land utilized for interceptor right-of-way and for the WWTP sites would be committed at least for the useful life of the facilities (estimated at 50 years). | d) About 925 acres of land utilized for interceptor right-of-way and for the WWTP sites would be committed at least for the useful life of the facilities (estimated at 50 years). | d) An additional 5 acres of land would be utilized for the Flat Rock WWTP. Other WWTPs would be expanded on existing sites. |
| 14) Public Finance | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $155.3 million from US-EPA Construction Grants Program<br>● $10.4 million from Michigan Construction Grants Program<br>● $41.4 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $126.6 million from US-EPA Construction Grants Program<br>● $8.4 million from Michigan Construction Grants Program<br>● $33.8 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $153.9 million from US-EPA Construction Grants Program<br>● $10.3 million from Michigan Construction Grants Program<br>● $41.0 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $141.3 million from US-EPA Construction Grants Program<br>● $9.4 million from Michigan Construction Grants Program<br>● $37.7 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $115.1 million from US-EPA Construction Grants Program<br>● $7.7 million from Michigan Construction Grants Program<br>● $30.7 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. | a) Capital costs would require contributions from Federal (75%), State (5%), and local (20%) interests:<br>● $20.3 million from US-EPA Construction Grants Program<br>● $1.4 million from Michigan Construction Grants Program<br>● $5.4 million from participating communities.<br>(See Section 6.1.2. discussion of individual community impact.) This represents a significant social cost in respect to alternative public goods foregone. |
| 15) Aesthetics | a) Odors, noise, and visual impacts of construction would produce temporary adverse aesthetic impacts [see 1) and 2) above for odor and noise]. Removal of vegetation along the right-of-way and at the WWTP site, and construction activity (especially in wooded areas, wetlands, waterways, and parklands) could degrade visual appreciation of the landscape by some individuals. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Odors, noise, and visual impacts of construction temporarily would degrade aesthetics locally at five WWTPs. |

Table 26. Alternative A-1, estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. (An "NA" indicates communities which would not be served; Twp. indicates township.)

| Community | 1 Community Share of Total Local Capital Costs ($ X 1000) | 2 Average Annual Cost of Amortization (25 yrs. @ 7.5%) ($ X 1000) | 3 Community Share of Average Annual O&M ($ X 1000) | 4 Total Average Annual Community Cost ($ X 1000) | 5 Total Community Cost Over 20 Years ($ X 1000) | 6 Estimated Average Annual Cost Per Sewered Capita ($) |
|---|---|---|---|---|---|---|
| White Lake Twp. | NA | NA | NA | NA | NA | NA |
| Commerce Twp. | 5,843 | 524 | 249 | 773 | 15,460 | 28 |
| Wolverine Lake | NA | NA | NA | NA | NA | NA |
| Walled Lake | 1,032 | 93 | 64 | 157 | 3,140 | 22 |
| Novi | 5,550 | 493 | 472 | 965 | 19,300 | 22 |
| Northville | 1,007 | 90 | 76 | 166 | 3,320 | 34 |
| Northville Twp | 3,526 | 316 | 381 | 697 | 13,940 | 18 |
| Plymouth Twp. | 3,623 | 325 | 347 | 672 | 13,440 | 26 |
| Plymouth | NA | NA | NA | NA | NA | NA |
| Canton Twp. | 4,329 | 388 | 451 | 839 | 16,780 | 19 |
| Van Buren Twp. | 3,962 | 355 | 437 | 792 | 15,840 | 18 |
| Romulus | 205 | 18 | 23 | 41 | 820 | 16 |
| Belleville | NA | NA | NA | NA | NA | NA |
| Sumpter Twp. | 1,745 | 157 | 168 | 325 | 6,500 | 18 |
| Huron Twp. | 1,477 | 132 | 242 | 374 | 7,480 | 16 |
| Flat Rock | 1,434 | 129 | 250 | 379 | 7,580 | 26 |
| Rockwood | 329 | 30 | 64 | 94 | 1,880 | 16 |
| South Rockwood | 88 | 8 | 17 | 25 | 500 | 14 |
| Trenton | 4,156 | 373 | 808 | 1,181 | 23,620 | 32 |
| Woodhaven | 1,089 | 98 | 209 | 307 | 6,140 | 24 |
| Gibraltar | 923 | 83 | 180 | 263 | 5,260 | 32 |
| Brownstown Twp. | 1,060 | 95 | 205 | 300 | 6,000 | 20 |
| Total | 41,328 | 3,707 | 4,643 | 8,350 | 167,000 | |

133

Table 27. Alternative A-2estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. Net debt and net debt as a percentage of SEV are presented. (An "NA" indicates communities which would not be served by an alternative or which would not require capital expenditures. The notation "NC" indicates insufficient data to calculate values. "Twp." indicates township.)

| Community | 1 Community Share of Total Local Capital Costs ($ x 1,000) | 2 Average Annual Cost of Amortization (25 yrs. @ 7.5%) by Community ($ x 1,000) | 3 Community Share of Average Annual Operation and Maintenance ($ x 1,000) | 4 Total Average Annual Community Cost ($ x 1,000) | 5 Total Community Cost Over 20 Years ($ x 1,000) | 6 Estimated Average Annual Cost Per Capita 1985 ($) | 7 Estimated Average Annual Cost Per Capita Peak Year of Sewered Population ($) | 8 Estimated 1980 Net Debt Per Capita ($) | 9 Estimated Increase In Net Debt Per Capita 1977 - 1980 (%) | 10 Estimated 1980 Net Debt As A Percentage of State Equalized Valuation (SEV) |
|---|---|---|---|---|---|---|---|---|---|---|
| White Lake Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Commerce Twp. | 4,531 | 406.5 | 64.3 | 470.8 | 9,416 | 24 | 37 | 714 | 71 | 7.8 |
| Wolverine Lake | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Walled Lake | 780 | 70.0 | 40.1 | 110.1 | 2,202 | 29 | 29 | 516 | 93 | 6.9 |
| Novi | 3,431 | 307.8 | 242.2 | 550.0 | 11,000 | 19 | 27 | 1,007 | 15 | 13.4 |
| Northville | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Northville Twp. | 719 | 64.5 | 68.5 | 133.0 | 2,660 | 6 | 6 | 726 | 7 | 10.6 |
| Plymouth Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Plymouth | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Canton Twp. | 6,922 | 621.0 | 659.2 | 1,280.2 | 25,604 | 21 | 21 | 633 | 38 | 9.4 |
| Van Buren Twp. | 4,305 | 386.2 | 438.8 | 825.0 | 16,500 | 25 | 19 | 790 | 34 | 14.5 |
| Romulus | 245 | 22.0 | 27.4 | 49.4 | 988 | NC | 19 | NC | NC | NC |
| Belleville | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sumpter Twp. | 1,792 | 160.8 | 64.3 | 225.1 | 4,502 | 21 | 13 | 591 | 68 | 12.4 |
| Huron Twp. | 1,273 | 114.2 | 136.9 | 251.1 | 5,022 | 20 | 14 | 1,208 | 19 | 19.4 |
| Flat Rock | 1,494 | 134.0 | 258.0 | 392.0 | 7,840 | 33 | 31 | 1,012 | 30 | 6.5 |
| Rockwood | 253 | 22.7 | 55.8 | 78.5 | 1,570 | 27 | 22 | 644 | 22 | 10.5 |
| South Rockwood | 152 | 13.6 | 17.9 | 31.5 | 630 | NC | 11 | NC | NC | NC |
| Trenton | 3,176 | 284.9 | 652.2 | 937.1 | 18,742 | 45 | 42 | 1,181 | 22 | 7.4 |
| Woodhaven | 993 | 89.1 | 187.2 | 276.3 | 5,526 | 29 | 29 | 2,402 | 7 | 18.7 |
| Gibraltar | 530 | 47.5 | 107.0 | 154.5 | 3,090 | 47 | 38 | 999 | 25 | 9.1 |
| Brownstown Twp. | 2,680 | 240.4 | 437.1 | 677.5 | 13,550 | 12 | 20 | 784 | 16 | 13.6 |
| TOTAL: | 33,276 | 2,985.2 | 3,456.9 | 6,442.1 | 128,842 | | | | | |
| Average | 2,080 | 186.6 | 216.1 | 402.6 | 8,052 | 25.6 | 23.6 | 943 | 33 | 11.4 |
| Standard Deviation | 1,939 | 174.0 | 216.9 | 364.6 | 7,292 | 11.1 | 10.3 | 473 | 26 | 4.1 |
| Range | 152 to 6,922 | 13.6 to 621.0 | 17.9 to 659.2 | 31.5 to 1,280.2 | 630 to 25,604 | 6 to 47 | 6 to 42 | 516 to 2,402 | 7 to 93 | 6.5 to 19.4 |

Table 28. Alternative B, estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. Net debt and net debt as a percentage of SEV are presented. (An "NA" indicates communities which would not be served by an alternative or which would not require capital expenditures. The notation "NC" indicates insufficient data to calculate values. "Twp." indicates township. )

| Community | 1<br>Community Share of Total Local Capital Costs ($ x 1,000) | 2<br>Average Annual Cost of Amortization (25 yrs. @ 7.5%) by Community ($ x 1,000) | 3<br>Community Share of Average Annual Operation and Maintenance ($ x 1,000) | 4<br>Total Average Annual Community Cost ($ x 1,000) | 5<br>Total Community Cost Over 20 Years ($ x 1,000) | 6<br>Estimated Average Annual Cost Per Capita 1985 ($) | 7<br>Estimated Average Annual Cost Per Capita Peak Year of Sewered Population ($) | 8<br>Estimated 1980 Net Debt Per Capita ($) | 9<br>Estimated Increase In Net Debt Per Capita 1977 - 1980 (%) | 10<br>Estimated 1980 Net Debt As A Percentage of State Equalized Valuation (SEV) |
|---|---|---|---|---|---|---|---|---|---|---|
| White Lake Twp. | 5,126 | 459.9 | 175.8 | 635.7 | 12,714 | 24 | 28 | 593 | 52 | 11.4 |
| Commerce Twp. | 2,506 | 224.8 | 62.2 | 287.0 | 5,740 | 15 | 23 | 566 | 36 | 8.2 |
| Wolverine Lake | 795 | 71.3 | 41.9 | 113.2 | 2,264 | 25 | 24 | NC | NC | NC |
| Walled Lake | 552 | 49.5 | 38.9 | 88.4 | 1,768 | 24 | 23 | 419 | 56 | 5.6 |
| Novi | 2,625 | 235.5 | 335.7 | 571.2 | 11,424 | [illegible] | 28 | 957 | 9 | 12.7 |
| Northville | 833 | 74.7 | 100.2 | 174.9 | 3,498 | 33 | 31 | 1,956 | 17 | 18.8 |
| Northville Twp. | 3,150 | 282.6 | 290.7 | 573.3 | 11,466 | 27 | 25 | 656 | 26 | 12.7 |
| Plymouth Twp. | 2,911 | 261.1 | 305.9 | 567.0 | 11,340 | 25 | 24 | 711 | 27 | 7.5 |
| Plymouth | 1,413 | 126.8 | 143.4 | 270.2 | 5,404 | 14 | 22 | 620 | 29 | 8.1 |
| Canton Twp. | 5,769 | 517.5 | 640.2 | 1,157.7 | 23,154 | 27 | 23 | 571 | 19 | 8.5 |
| Van Buren Twp. | 3,806 | 341.4 | 420.4 | 761.8 | 15,236 | 21 | 17 | 718 | 22 | 17.2 |
| Romulus | 211 | 18.9 | 26.8 | 45.7 | 914 | NC | 18 | NC | NC | NC |
| Belleville | 569 | 51.0 | 96.3 | 147.3 | 2,946 | [illegible] | 31 | 475 | [illegible] | 14.2 |
| Sumpter Twp. | 1,615 | 144.9 | 62.2 | 207.1 | 4,142 | 19 | 22 | [illegible] | 44 | 10.4 |
| Huron Twp. | 1,115 | 100.0 | 133.1 | 233.1 | 4,662 | 27 | 17 | 1,131 | 33 | 19.1 |
| Flat Rock | 1,303 | 116.9 | 250.6 | 367.5 | 7,350 | 31 | 25 | 423 | 37 | 5.9 |
| Rockwood | 224 | 20.1 | 54.4 | 74.5 | 1,490 | [illegible] | 25 | 595 | 32 | 6.7 |
| South Rockwood | 133 | 11.9 | 17.2 | 29.1 | 582 | NC | 17 | NC | NC | NC |
| Trenton | 2,800 | 251.2 | 273.7 | [illegible] | [illegible] | 8 |  | 1,147 |  | 4.8 |
| Woodhaven | 855 | 76.7 | 164.6 | 241.3 | 4,826 | 28 | 23 | 1,128 | 5 | 17.9 |
| Gibraltar | 465 | 41.7 | 94.1 | 135.8 | 2,716 | 41 | 32 | 900 | 14 | 9.2 |
| Brownstown Twp. | 2,276 | 204.2 | 391.9 | 596.1 | 11,922 | 33 | 27 | 796 | 9 | 11.7 |
| TOTAL: | 41,052 | 3,682.6 | 4,420.1 | 8,102.7 | [illegible] |  |  |  |  |  |
| Average | 1,866 | 167.4 | 200.9 | 368.3 | 7,364 | 26.1 | 23.9 | 809 | 24 | 11.7 |
| Standard Deviation | 1,582 | 142.0 | 179.2 | 306.7 | 6,134 | [illegible] | [illegible] | 262 | [illegible] | 4.1 |
| Range | 133 to 5,769 | 11.9 to 517.5 | 17.2 to 640.2 | 29.1 to 1,157.7 | 582 to 23,154 | 13 to 41 | 17 to 31 | 419 to 1,956 | 5 to 56 | 4.8 to 19.1 |

Table 29. Alternative C, estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. Net debt and net debt as a percentage of SEV are presented. (An "NA" indicates communities which would not be served by an alternative or which would not require capital expenditures. The notation "NC" indicates insufficient data to calculate values. "Twp." indicates township.)

| Community | 1 Community Share of Total Local Capital Costs ($ x 1,000) | 2 Average Annual Cost of Amortization (25 yrs. @ 7.5%) by Community ($ x 1,000) | 3 Community Share of Average Annual Operation and Maintenance ($ x 1,000) | 4 Total Average Annual Community Cost ($ x 1,000) | 5 Total Community Cost Over 20 Years ($ x 1,000) | 6 Estimated Average Annual Cost Per Capita 1985 ($) | 7 Estimated Average Annual Cost Per Capita Peak Year of Sewered Population ($) | 8 Estimated 1980 Net Debt Per Capita ($) | 9 Estimated Increase In Net Debt Per Capita 1977 - 1980 (%) | 10 Estimated 1980 Net Debt As A Percentage of State Equalized Valuation (SEV) |
|---|---|---|---|---|---|---|---|---|---|---|
| White Lake Twp. | 2,588 | 232.2 | 363.0 | 595.2 | 11,904 | 22 | 26 | [illegible] | 26 | 10.6 |
| Commerce Twp. | 1,118 | 100.3 | 128.7 | 229.0 | 4,580 | 12 | 18 | 481 | 15 | 5.3 |
| Wolverine Lake | 347 | 31.1 | 86.5 | 117.6 | 2,352 | 26 | 29 | NC | NC | NC |
| Walled Lake | 143 | 12.8 | 80.2 | 93.0 | 1,860 | 25 | 24 | 308 | 15 | 4.1 |
| Novi | 2,307 | 207.0 | 286.1 | 493.1 | 9,862 | 17 | 25 | 947 | 8 | 12.6 |
| Northville | 889 | 79.8 | 109.2 | 189.0 | 3,780 | 36 | 32 | 1,567 | 17 | 18.9 |
| Northville Twp. | 3,470 | 311.3 | 316.3 | 627.6 | 12,552 | 30 | 28 | 874 | 29 | 12.8 |
| Plymouth Twp. | 3,206 | 287.6 | 333.0 | 620.6 | 12,412 | 31 | 27 | 748 | 29 | 7.6 |
| Plymouth | 1,578 | 141.6 | 156.0 | 297.6 | 5,952 | 26 | 24 | 633 | 27 | 8.2 |
| Canton Twp. | 6,270 | 562.5 | 697.2 | 1,259.7 | 25,194 | 21 | 21 | 581 | 27 | 8.6 |
| Van Buren Twp. | 3,668 | 329.1 | 457.7 | 786.8 | 15,736 | 24 | 18 | 713 | 21 | 13.1 |
| Romulus | 226 | 20.3 | 29.0 | 49.3 | 986 | NC | 19 | NC | NC | NC |
| Belleville | 599 | 53.7 | 104.7 | 158.4 | 3,168 | 33 | 33 | 382 | 35 | 14.4 |
| Sumpter Twp. | 1,680 | 150.7 | 67.9 | 218.6 | 4,372 | 25 | 13 | 513 | 46 | 10.7 |
| Huron Twp. | 1,151 | 103.3 | 144.7 | 248.0 | 4,960 | 19 | 13 | 1,134 | 11 | 18.3 |
| Flat Rock | 1,336 | 119.9 | 272.9 | 392.8 | 7,856 | 33 | 31 | 915 | 18 | 5.9 |
| Rockwood | 230 | 20.6 | 59.0 | 79.6 | 1,592 | 27 | 22 | 597 | 13 | 9.7 |
| South Rockwood | 135 | 12.1 | 19.0 | 31.1 | 622 | NC | 11 | NC | NC | NC |
| Trenton | 2,863 | 256.8 | 624.8 | 881.6 | 17,632 | 42 | 40 | 1,090 | 17 | 6.6 |
| Woodhaven | 674 | 60.4 | 197.3 | 257.7 | 5,154 | 27 | 27 | 2,330 | 3 | 18.0 |
| Gibraltar | 475 | 42.6 | 102.5 | 145.1 | 2,902 | 44 | 36 | 908 | 14 | 8.2 |
| Brownstown Twp. | 2,325 | 208.6 | 426.5 | 635.1 | 12,702 | 12 | 19 | 735 | 9 | 12.8 |
| TOTAL: | 37,478 | 3,362.3 | 5,044.2 | 8,406.5 | 168,130 | | | | | |
| Average | 1,704 | 152.8 | 229.3 | 382.1 | 7,642 | 26.4 | 24.4 | 845 | 20 | 10.9 |
| Standard Deviation | 1,527 | 137.0 | 190.4 | 318.9 | 6,378 | 8.7 | 7.6 | 465 | 11 | 4.4 |
| Range | 135 to 6,270 | 12.1 to 562.5 | 19.0 to 697.2 | 31.1 to 1,259.7 | 622 to 25,194 | 12 to 44 | 11 to 40 | 308 to 2,330 | 3 to 46 | 4.1 to 18.9 |

Table 30. Alternative D, estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. Net debt and net debt as a percentage of SEV are presented. (An "NA" indicates communities which would not be served by an alternative or which would not require capital expenditures. The notation "NC" indicates insufficient data to calculate values. "Twp." indicates township.)

| Community | 1<br>Community Share of Total Local Capital Costs ($ x 1,000) | 2<br>Average Annual Cost of Amortization (25 yrs. @ 7.5%) by Community ($ x 1,000) | 3<br>Community Share of Average Annual Operation and Maintenance ($ x 1,000) | 4<br>Total Average Annual Community Cost ($ x 1,000) | 5<br>Total Community Cost Over 20 Years ($ x 1,000) | 6<br>Estimated Average Annual Cost Per Capita 1985 ($) | 7<br>Estimated Average Annual Cost Per Capita Peak Year of Sewered Population ($) | 8<br>Estimated 1980 Net Debt Per Capita ($) | 9<br>Estimated Increase In Net Debt Per Capita 1977 - 1980 (%) | 10<br>Estimated 1980 Net Debt As A Percentage of State Equalized Valuation (SEV) |
|---|---|---|---|---|---|---|---|---|---|---|
| White Lake Twp. | 2,588 | 232.2 | 363.0 | 595.2 | 11,904 | 22 | 26 | 493 | 26 | 10.6 |
| Commerce Twp. | 1,118 | 100.3 | 128.7 | 229.0 | 4,580 | 12 | 18 | 481 | 15 | 5.3 |
| Wolverine Lake | 347 | 31.1 | 86.5 | 117.6 | 2,352 | 26 | 29 | NC | NC | NC |
| Walled Lake | 143 | 12.8 | 80.2 | 93.0 | 1,860 | 25 | 24 | 308 | 15 | 4.1 |
| Novi | 232 | 20.8 | 63.3 | 84.1 | 1,682 | 3 | 21 | 879 | 1 | 11.7 |
| Northville | 27 | 2.4 | 0 | 2.4 | 48 | 1 | 1 | 1,422 | 7 | 17.1 |
| Northville Twp. | 131 | 11.8 | 0 | 11.8 | 236 | 1 | 1 | 682 | 1 | 10.0 |
| Plymouth Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Plymouth | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Canton Twp. | 8,746 | 734.6 | 678.1 | 1,462.7 | 29,254 | 24 | 24 | 630 | 37 | 9.3 |
| Van Buren Twp. | 4,626 | 415.0 | 468.1 | 883.1 | 17,662 | 27 | 20 | 746 | 26 | 13.7 |
| Romulus | 286 | 25.7 | 27.1 | 52.8 | 1,056 | NC | 21 | NC | NC | NC |
| Belleville | 448 | 40.2 | 98.2 | 138.4 | 2,768 | 29 | 29 | 450 | 26 | 13.5 |
| Sumpter Twp. | 855 | 166.4 | 181.8 | 348.2 | 6,964 | 32 | 20 | 530 | 51 | 11.1 |
| Huron Twp. | 1,304 | 117.0 | 216.3 | 333.3 | 6,666 | 26 | 18 | 1,150 | 13 | 18.5 |
| Flat Rock | 1,524 | 136.7 | 263.2 | 399.9 | 7,998 | 33 | 32 | 934 | 20 | 6.0 |
| Rockwood | 257 | 23.1 | 50.1 | 73.2 | 1,464 | 25 | 20 | 608 | 15 | 9.9 |
| South Rockwood | 156 | 14.0 | 29.2 | 43.2 | 864 | NC | 15 | NC | NC | NC |
| Trenton | 2,960 | 265.5 | 586.2 | 851.7 | 17,034 | 41 | 38 | 1,394 | 13 | 6.9 |
| Woodhaven | 901 | 80.8 | 170.3 | 251.1 | 5,022 | 27 | 26 | 2,332 | 3 | 18.0 |
| Gibraltar | 402 | 36.1 | 96.2 | 132.3 | 2,646 | 40 | 33 | 890 | 12 | 8.1 |
| Brownstown Twp. | 2,399 | 215.2 | 448.2 | 663.4 | 13,268 | 12 | 19 | 737 | 10 | 12.8 |
| TOTAL: | 30,450 | 2,731.7 | 4,034.7 | 6,766.4 | 135,328 | | | | | |
| Average | 1,522 | 136.6 | 201.7 | 338.3 | 6,766 | 22.6 | 21.8 | 845 | 17 | 11.0 |
| Standard Deviation | 2,090 | 187.5 | 202.2 | 379.3 | 7,586 | 12.1 | 9.2 | 478 | 13 | 4.3 |
| Range | 27 to 8,746 | 2.4 to 784.6 | 0 to 678.1 | 2.4 to 1,462.7 | 48 to 29,254 | 1 to 41 | 1 to 38 | 308 to 2,332 | 1 to 51 | 4.1 to 18.5 |

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Table 31. Alternative E, estimated allocation of costs to communities and townships in the Huron Valley Wastewater Control System project area, Michigan. Net debt and net debt as a percentage of SEV are presented. (An "NA" indicates communities which would not be served by an alternative or which would not require capital expenditures. The notation "NC" indicates insufficient data to calculate values. "Twp." indicates township.)

| Community | 1 Community Share of Total Local Capital Costs ($ x 1,000) | 2 Average Annual Cost of Amortization (25 yrs. @ 7.5%) by Community ($ x 1,000) | 3 Community Share of Average Annual Operation and Maintenance ($ x 1,000) | 4 Total Average Annual Community Cost ($ x 1,000) | 5 Total Community Cost Over 20 Years ($ x 1,000) | 6 Estimated Average Annual Cost Per Capita 1985 ($) | 7 Estimated Average Annual Cost Per Capita Peak Year of Sewered Population ($) | 8 Estimated 1980 Net Debt Per Capita ($) | 9 Estimated Increase In Net Debt Per Capita 1977 - 1980 (%) | 10 Estimated 1980 Net Debt As A Percentage of State Equalized Valuation (SEV) |
|---|---|---|---|---|---|---|---|---|---|---|
| White Lake Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Commerce Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Wolverine Lake | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Walled Lake | NA | NA | 95.0 | 95.0 | 1,900 | 25 | 25 | NA | NA | NA |
| Novi | NA | NA | 105.0 | 105.0 | 2,100 | 4 | 26 | NA | NA | NA |
| Northville | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Northville Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Plymouth Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Plymouth | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Canton Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Van Buren Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Romulus | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Belleville | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sumpter Twp. | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Huron Twp. | 981 | 88.0 | 300.0 | 388.0 | 7,760 | 30 | 21 | 1,118 | 9.7 | 18.0 |
| Flat Rock | 1,194 | 107.1 | 365.1 | 472.2 | 9,444 | 39 | 37 | 901 | 15.8 | 5.8 |
| Rockwood | 28 | 2.5 | 126.3 | 128.8 | 2,576 | 44 | 36 | 537 | 1.5 | 8.7 |
| South Rockwood | 16 | 1.4 | 73.7 | 75.1 | 1,502 | NC | 27 | NC | NC | NC |
| Trenton | 41 | 3.7 | 840.0 | 843.7 | 16,874 | 40 | 38 | 970 | 0.2 | 6.1 |
| Woodhaven | 740 | 66.4 | 230.0 | 296.4 | 5,928 | 33 | 31 | 2,317 | 2.7 | 17.9 |
| Gibraltar | 402 | 36.1 | 129.8 | 165.9 | 3,318 | 51 | 41 | 890 | 11.7 | 8.1 |
| Brownstown Twp. | 1,990 | 179.5 | 678.3 | 856.8 | 17,136 | 16 | 25 | 727 | 8.0 | 12.6 |
| TOTAL: | 5,392 | 483.7 | 2,943.2 | 3,226.9 | 64,538 | | | | | |
| Average | 674 | 60.5 | 342.9 | 403.4 | 8,068 | 31.3 | 30.7 | 1,066 | 7 | 11.0 |
| Standard Deviation | 700 | 62.8 | 277.6 | 306.0 | 6,120 | 14.6 | 6.8 | 582 | 6 | 5.2 |
| Range | 16 to 1,990 | 1.4 to 178.5 | 73.7 to 840.0 | 75.1 to 856.8 | 1,502 to 17,136 | 4 to 44 | 21 to 41 | 537 to 2,317 | 0.2 to 15.8 | 6.1 to 18.0 |

bonds to finance the local share at an annual interest rate of 7.5% for a 25-year payment period. The communities would be responsible for reimbursing the county management agency annually through collection of user charges or possibly by the sale of local bonds (Section 6.2.2.).

## 6.2. Operation Impacts

### 6.2.1. Impacts on the Natural and Man-Made Environment

Operation of the regional WWTP proposed in Alternatives A through D, the expanded Walled Lake WWTP as proposed in Alternatives C and D, or the five upgraded and expanded WWTPs plus the continued operation of the existing Walled Lake WWTP as proposed in Alternative E, would create similar impacts. The most significant effects would be the improvement in effluent quality and the elimination of wide-spread reliance on septic tanks. Both would improve surface water quality. Primary, operational impacts associated with each system alternative are summarized in Table 32. Impacts are quantified where possible. Operation and maintenance costs for each system alternative are discussed in the following sections.

### 6.2.2. Impacts on Local Public Finance

The estimated annual operation and maintenance (O&M) costs for system alternatives are allocated to each participating community in Column 3 of Tables 26 through 31. Local interests must pay 100% of the total annual proportionate utilization of the system. O&M costs were assumed to be constant over the 20-year analysis period.

The combined annual community cost (capital debt retirement plus O&M) is shown in Column 4 of Tables 26 through 31. Total community costs over the 20-year period are listed in Column 5 of the tables.

The importance of two measures of a community's financial condition, the net debt per capita and the net debt as a percentage of state equalized valuation (SEV), was discussed in Section 3.1.5. Evaluated against the background of the community's general economic condition, these measures may be used to estimate the capacity for taking on new debt. To estimate these parameters for 1980 it is assumed that the ratios reported for 1977 (Section 3.1.5.) will remain the same during the period from 1977 to 1980. Net debt and SEV are assumed to change in proportion to population. Each community's local share of capital cost is treated as additional debt incurred in 1980 and the ratios are recomputed. It is assumed that the population estimates presented in Section 3.1.5. are reached in 1980. No attempt has been made to forecast changes in costs during the planning period. Constant relative prices are assumed. This ignores the effects of inflation which will influence future costs.

Subsequent sections discuss financial impacts based on assumptions that costs would be borne either by the entire community population or only by its users. This neglects the fact that a part of O&M costs result from use

Table 32. Potential major primary impacts from operation of the Huron Valley Wastewater Control System, Michigan.

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 1) Air Quality and Odors | a) Operation of a 49.2 mgd WWTP would release malodorous gases and vapors, as would wet wells, pumping stations, and manholes. | a) Same as A-1, except that the capacity of the WWTP would be 37.0 mgd. | a) Same as A-1, except that the capacity of the WWTP would be 47.4 mgd. | a) Malodorous gases and vapors would be emitted from the 43.0 mgd regional WWTP at the Brownstown Township site and from the 4.8 mgd WWTP at the site of the existing Walled Lake WWTP (both are relatively rural locations), as well as from wet wells, pumping stations, and manholes in the system. | a) Same as C, except that the capacity of the WWTP size would be 32.0 mgd. | a) Odors would continue to be produced at each of the six WWTP sites. |
| | b) Incineration of an estimated average 38 tons (dry weight) per day of sludge would produce controlled emissions of up to 50 pounds per day of particulates, and insignificant amounts of sulfur dioxide, nitrous oxides; and could produce trace amounts of toxic organics and heavy metals. (The Brownstown Township WWTP site is in a non-attainment area for secondary air quality standards.) | b) Same as A-1, except that the incineration of an estimated average 29 tons (dry weight) of sludge would produce up to 38 pounds per day of particulates. | b) Same as A-1, except that the incineration of an estimated average 37 tons (dry weight) of sludge per day would produce up to 48 pounds per day of particulates. | b) Incineration of an estimated average 35 tons (dry weight) per day of sludge at the regional WWTP would produce controlled emissions of up to 46 pounds per day of particulates, and insignificant amounts of sulfur dioxide, nitrous oxides; and could produce trace amounts of toxic organics and heavy metals. (Brownstown Township is in a non-attainment area for secondary air quality standards.)<br>If incineration were utilized at the 4.8 mgd Walled Lake WWTP, emissions from incineration of 9 tons (dry weight) per day of sludge would produce less than 12 pounds per day of particulate emissions, insignificant amounts of sulfur dioxide and nitrous oxides; and could produce trace amounts of toxic organics and heavy metals. (Air quality in the Walled Lake WWTP area presently meets ambient air quality standards.) | b) Same as C, except that the incineration of an estimated average 26 tons (dry weight) per day of sludge would produce up to 34 pounds per day of particulates. | b) Incineration of an estimated average 18 tons (dry weight) per day of sludge from the five WWTPs in the southeast part of the project area (all included in the non-attainment area for secondary air quality standards) would produce controlled emissions of up to 23 pounds per day of particulates, and insignificant amounts of sulfur dioxide, and nitrous oxides; and could produce trace amounts of toxic organics and heavy metals. (Sites of potential new incinerators are not specified, although they would likely be in Trenton and Flat Rock with continued reliance on the existing incinerators at Wayne County-Wyandotte and Trenton.) |
| | c) The sources of potential odors at the six WWTP sites would be eliminated. | c) Same as A-1. | c) Same as A-1. | c) The sources of potential odors at the five existing WWTPS in the southeastern part of the project area would be eliminated. | c) Same as C. | c) Odors created by the present practice of bypassing raw sewage at the Flat Rock WWTP would be eliminated. |
| 2) Noise | a) A minimal increase in ambient noise levels would occur at the WWTP and Trenton Pump Station sites (an expected 48 dBA at 1,000 feet from the Brownstown Township WWTP site), and would be more noticeable at night. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Ambient noise levels near the five expanded WWTPs would increase minimally. |
| | b) Noise from the six existing WWTPs would be eliminated. | b) Same as A-1. | b) Same as A-1. | b) Noise from five existing WWTPs would be eliminated. Existing noise levels at the Walled Lake WWTP would be increased minimally. | b) Same as C. | b) Existing noise levels at the Walled Lake WWTP would be maintained. |

Table 32. Potential major primary impacts from operation of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 3) Geology, Soils, and Topography | a) Disposal of an estimated average 7 tons per day of incinerator ash and solids captured by incinerator emission control devices at an unspecified landfill would affect minimally topography at landfill sites. (This would be insignificant compared to the total volume of solid waste disposed of daily.) | a) Same as A-1, except that the estimated average daily amount of ash is 6 tons. | a) Same as A-2. | a) Same as A-1, except that the estimated volume of ash would average 7 tons per day from the 43.0 mgd WWTP and 2 tons per day from the 4.8 mgd Walled Lake WWTP (if incineration is used for sludge disposal at Walled Lake). | a) Same as C, except that the estimated volume of ash at the 32.0 mgd regional WWTP would average 5 tons per day. | a) Expansion and upgrading of the five existing WWTPs would generate increased volumes of sludge relative to existing conditions; disposal of liquid or dried sludge, or incineration ash (depending on the method of disposal chosen) would contribute to minimal change in local topography at the landfill site. (This would be insignificant compared to the total volume of solid waste disposed of daily.) |
| 4) Vegetation and Animals | a) Facilities operation would not result in impact to any Federal- or State-designated endangered or threatened species. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. |
| 5) Wetlands | a) Elimination of the Walled Lake WWTP discharge to the Walled Lake Branch may cause a decline in wetland productivity along the watercourse because of elimination of summer low-flow augmentation. | a) Same as A-1. | a) Same as A-1. | a) Continued discharge from the Walled Lake WWTP may assist maintenance of wetlands adjacent to the Walled Lake Branch through summertime low-flow augmentation. | a) Same as C. | a) Same as C. |
|  | b) Under extreme adverse conditions (plant failure), effluent discharge from the proposed regional WWTP may have a minimal effect on wetlands on the west shore of Lake Erie to the south of the outfall location. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Failure of a WWTP could result in adverse impacts to the wetlands adjacent to the Walled Lake Branch of the Middle River Rouge, the Lower Huron River, or the western shore of Lake Erie, especially during low-flow periods at local sites. |
| 6) Surface Water | a) Effluent discharges from the six existing WWTPs would be eliminated, improving downstream water quality. An estimated 56.6 tons per year of phosphorus loading to Lake Erie would be eliminated. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1, except that there would be an increased discharge from the Walled Lake WWTP. | a) Same as C. | a) Effluent discharges from five of the six existing WWTPs would increase in volume compared to present discharges, but would receive higher levels of treatment. An estimated 27.9 tons per year of phosphorus loading to Lake Erie would occur. |
|  | b) Elimination of NPDES permit violations by the Flat Rock (especially the bypass of raw sewage), Rockwood, W.C.-Trenton, and Brownstown Township WWTPs should improve the quality of the receiving waters. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. | b) Same as A-1. |

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# TABLE OF CONTENTS

| | | Page | |
|---|---|---|---|
| COVER SHEET | | i | 1/A5 |
| TABLE OF CONTENTS | | iii | 1/A7 |
| LIST OF TABLES | | vii | 1/A11 |
| LIST OF FIGURES | | viii | 1/A12 |
| LIST OF ABBREVIATIONS | | ix | 1/A13 |
| GLOSSARY OF GEOGRAPHICAL TERMS | | x | 1/A14 |
| SUMMARY | | xi | 1/B1 |
| 1.0. | INTRODUCTION | 1 | 1/B12 |
| 1.1. | Proposed Action | 1 | 1/B12 |
| 1.2. | Background | 1 | 1/B12 |
| 1.3. | Study Process | 5 | 1/C2 |
| 2.0. | NATURAL ENVIRONMENT | 8 | 1/C5 |
| 2.1. | Atmosphere | 8 | 1/C5 |
| 2.1.1. | Climate | 8 | 1/C5 |
| 2.1.2. | Air Quality | 8 | 1/C5 |
| 2.1.3. | Sound | 10 | 1/C7 |
| 2.2. | Land | 10 | 1/C7 |
| 2.2.1. | Physiography and Topography | 10 | 1/C7 |
| 2.2.2. | Geology | 11 | 1/C8 |
| 2.2.2.1. | Surficial Geology | 11 | 1/C8 |
| 2.2.2.2. | Bedrock Geology | 12 | 1/C9 |
| 2.2.3. | Soil | 14 | 1/C11 |
| 2.2.4. | Terrestrial Vegetation | 17 | 1/D1 |
| 2.2.4.1. | Woodlands | 17 | 1/D1 |
| 2.2.4.2. | Brushlands and Grasslands | 18 | 1/D2 |
| 2.2.4.3. | Agricultural Land | 18 | 1/D2 |
| 2.2.4.4. | Wetlands | 18 | 1/D2 |
| 2.2.4.5. | Endangered, Threatened, and Rare Plants | 19 | 1/D3 |
| 2.2.5. | Wildlife | 19 | 1/D3 |
| 2.2.5.1. | Amphibians | 19 | 1/D3 |
| 2.2.5.2. | Reptiles | 21 | 1/D5 |
| 2.2.5.3. | Birds | 21 | 1/D5 |
| 2.2.5.4. | Mammals | 21 | 1/D5 |
| 2.2.5.5. | Endangered and Threatened Animals | 21 | 1/D5 |
| 2.3. | Water | 22 | 1/D6 |
| 2.3.1. | Surface Water | 22 | 1/D6 |
| 2.3.1.1. | Setting and Flow | 22 | 1/D6 |
| 2.3.1.2. | Uses | 28 | 1/D12 |
| 2.3.1.3. | Water Quality | 29 | 1/D13 |
| 2.3.2. | Groundwater | 33 | 1/E3 |
| 2.3.2.1. | Occurrence | 33 | 1/E3 |
| 2.3.2.2. | Groundwater Quality | 34 | 1/E4 |
| 2.3.2.3. | Uses | 34 | 1/E4 |

## TABLE OF CONTENTS (Cont.)

Page

2.3.3. Aquatic Biota . . . . . . . . . . . . . . . . . . . . . 34 1/E4
2.3.3.1. Upper and Lower Huron River. . . . . . . . . 34 1/E4
2.3.3.2. Middle and Lower Rivers Rouge. . . . . . . . 35 1/E5
2.3.3.3. Detroit River - Lake Erie. . . . . . . . . . 35 1/E5
2.3.3.4. Threatened and Endangered Species . . . . . 36 1/E6

3.0. MAN-MADE ENVIRONMENT. . . . . . . . . . . . . . . . . . . . 37 1/E7
3.1. Demography and Economics . . . . . . . . . . . . . . . 37 1/E7
3.1.1. Demographic Trends . . . . . . . . . . . . . . . . 37 1/E7
3.1.2. Population Projections . . . . . . . . . . . . . . 39 1/E10
3.1.3. Income . . . . . . . . . . . . . . . . . . . . . . 40 1/E11
3.1.4. Employment . . . . . . . . . . . . . . . . . . . . 42 1/E13
3.1.5. Public Finance . . . . . . . . . . . . . . . . . . 47 1/F7
3.2. Land Use and Transportation . . . . . . . . . . . . . . 54 1/G4
3.2.1. General Land Use..... . . . . . . . . . . . . . . 54 1/G4
3.2.2. Existing Land Use . . . . . . . . . . . . . . . . 54 1/G4
3.2.3. Recreational Land . . . . . . . . . . . . . . . . 56 1/G6
3.2.4. Housing . . . . . . . . . . . . . . . . . . . . . 56 1/G6
3.2.5. Transportation . . . . . . . . . . . . . . . . . 58 1/G8
3.3. Cultural, Historic, and Archaeological Resources . . . . . 58 1/G8
3.3.1. Prehistory of the Project Area . . . . . . . . . . 58 1/G8
3.3.2. History of the Project Area . . . . . . . . . . . 60 1/G10
3.3.3. Sites in the Project Area . . . . . . . . . . . . 61 1/G11
3.4. Wastewater Collection and Treatment Systems . . . . . . . 64 1/G14
3.4.1. Walled Lake - Novi . . . . . . . . . . . . . . . . 64 1/G14
3.4.2. Rouge Valley System . . . . . . . . . . . . . . . 67 2/A8
3.4.3. Downriver System . . . . . . . . . . . . . . . . . 69 2/A11
3.4.4. Flat Rock . . . . . . . . . . . . . . . . . . . . 72 2/A14
3.4.5. Rockwood . . . . . . . . . . . . . . . . . . . . . 73 2/B1
3.4.6. W.C. - Trenton . . . . . . . . . . . . . . . . . . 74 2/B2
3.4.7. Trenton . . . . . . . . . . . . . . . . . . . . . 75 2/B3
3.4.8. Southern Brownstown Township . . . . . . . . . . . 77 2/B5
3.4.9. Individual Disposal Systems . . . . . . . . . . . 78 2/B6

4.0. FUTURE SITUATION WITHOUT ACTION . . . . . . . . . . . . . . . 80 2/B8

5.0. ALTERNATIVES ANALYSIS . . . . . . . . . . . . . . . . . . . . 83 2/B11
5.1. Introduction . . . . . . . . . . . . . . . . . . . . . 83 2/B11
5.2. Component Options . . . . . . . . . . . . . . . . . . . 83 2/B11
5.2.1. Flow and Waste Reduction . . . . . . . . . . . . . 83 2/B11
5.2.1.1. Infiltration/Inflow Reduction. . . . . . . . 83 2/B11
5.2.1.2. Conservation of Water . . . . . . . . . . . . 84 2/B12
5.2.1.3. Diversion of Flows . . . . . . . . . . . . . 85 2/B13
5.2.1.4. Flow Equalization . . . . . . . . . . . . . . 86 2/B14
5.2.1.5. Industrial Pretreatment and/or Reuse . . . . 86 2/B14
5.2.2. Collection System . . . . . . . . . . . . . . . . 86 2/B14
5.2.3. Wastewater Treatment Processes . . . . . . . . . . 88 2/C2
5.2.3.1. Primary Treatment . . . . . . . . . . . . . . 89 2/C3
5.2.3.2. Secondary Treatment . . . . . . . . . . . . . 89 2/C3

TABLE OF CONTENTS (Cont.)

Page

5.2.3.2.1. Activated Sludge . . . . . . . . 89 2/C3
5.2.3.2.2. Trickling Filter . . . . . . . . 89 2/C3
5.2.3.2.3. Lagoons . . . . . . . . . . 90 2/C4
5.2.3.2.4. Land Treatment . . . . . . . . 90 2/C4
5.2.3.3. Advanced Wastewater Treatment . . . . . . 91 2/C5
5.2.3.4. Disinfection . . . . . . . . . . . . . . . . 91 2/C5
5.2.4. Effluent Disposal Methods and Sites . . . . . . . . . 91 2/C5
5.2.5. Sludge Processing and Disposal . . . . . . . . . . 92 2/C6
5.2.5.1. Digestion . . . . . . . . . . . . . . . . . 92 2/C6
5.2.5.2. Incineration . . . . . . . . . . . . . . . . 93 2/C7
5.2.5.3. Pyrolysis . . . . . . . . . . . . . . . . . 93 2/C7
5.2.5.4. Wet Oxidation . . . . . . . . . . . . . . . 93 2/C7
5.2.5.5. Concentration of Sludge . . . . . . . . . . 94 2/C8
5.2.5.6. Conditioning . . . . . . . . . . . . . . . . 94 2/C8
5.2.5.7. Dewatering and Drying . . . . . . . . . . 94 2/C8
5.2.5.8. Land Disposal . . . . . . . . . . . . . . . 94 2/C8
5.3. System Alternatives . . . . . . . . . . . . . . . . . . 95 2/C9
5.3.1. Alternative A . . . . . . . . . . . . . . . . . . . 95 2/C9
5.3.1.1. Alternative A-1 . . . . . . . . . . . . . . 96 2/C10
5.3.1.1.1. Components . . . . . . . . . . . 96 2/C10
5.3.1.1.2. Construction and Operation Costs . . . . . . . . . . . . . 100 2/C14
5.3.1.2. Alternative A-2 . . . . . . . . . . . . . . 101 2/D1
5.3.1.2.1. Components . . . . . . . . . . . 101 2/D1
5.3.1.2.2. Construction and Operation Costs . . . . . . . . . . . . . 103 2/D3
5.3.2. Alternative B . . . . . . . . . . . . . . . . . . . 104 2/D4
5.3.2.1. Components . . . . . . . . . . . . . . . . 104 2/D4
5.3.2.2. Construction and Operation Costs . . . . . 107 2/D7
5.3.3. Alternative C . . . . . . . . . . . . . . . . . . . 107 2/D7
5.3.3.1. Components . . . . . . . . . . . . . . . . 107 2/D7
5.3.3.2. Construction and Operation Costs . . . . . 110 2/D10
5.3.4. Alternative D . . . . . . . . . . . . . . . . . . . 110 2/D10
5.3.4.1. Components . . . . . . . . . . . . . . . . 110 2/D10
5.3.4.2. Construction and Operation Costs . . . . . 114 2/D14
5.3.5. Alternative E . . . . . . . . . . . . . . . . . . . 117 2/E3
5.3.5.1. Components . . . . . . . . . . . . . . . . 117 2/E3
5.3.5.2. Construction and Operation Costs . . . . . 122 2/E8

6.0. IMPACTS OF ALTERNATIVES . . . . . . . . . . . . . . . . . . . . . 125 2/E11
6.1. Construction Impacts . . . . . . . . . . . . . . . . . 125 2/E11
6.1.1. Impacts on the Natural and Man-Made Environment . . 125 2/E11
6.1.2. Impacts on Local Public Finance . . . . . . . . . . 125 2/E11
6.2. Operation Impacts . . . . . . . . . . . . . . . . . . . 138 2/G9
6.2.1. Impacts on the Natural and Man-Made Environment . . 138 2/G9
6.2.2. Impacts on Local Public Finance . . . . . . . . . . 138 2/G9
6.2.2.1. Alternative A-1 . . . . . . . . . . . . . . 145 3/A12
6.2.2.2. Alternative A-2 . . . . . . . . . . . . . . 147 3/A14
6.2.2.3. Alternative B . . . . . . . . . . . . . . . 148 3/B1
6.2.2.4. Alternative C . . . . . . . . . . . . . . . 149 3/B2
6.2.2.5. Alternative D . . . . . . . . . . . . . . . 150 3/B3
6.2.2.6. Alternative E . . . . . . . . . . . . . . . 150 3/B3

## TABLE OF CONTENTS (Concluded)

Page

6.3. Secondary Impacts . . . . . . . . . . . . . . . . . . . . . . . 150 3/B3
  6.3.1. Indirect and Induced Growth . . . . . . . . . . . . 151 3/B4
  6.3.2. Impacts of Induced Growth . . . . . . . . . . . . . 152 3/B5
6.4. Minimization of Adverse Impacts . . . . . . . . . . . . . . 152 3/B5
  6.4.1. Construction Impacts . . . . . . . . . . . . . . . 152 3/B5
  6.4.2. Operation Impacts . . . . . . . . . . . . . . . . . 156 3/B10
  6.4.3. Secondary Impacts . . . . . . . . . . . . . . . . . 159 3/B13
6.5. Unavoidable Adverse Impacts . . . . . . . . . . . . . . . . 159 3/B13
6.6. Irretrievable and Irreversible Resource Commitments . . . . 160 3/B14
6.7. Short-term Versus Long-term Impacts . . . . . . . . . . . . 161 3/C1

7.0. CONCLUSIONS AND RECOMMENDATIONS . . . . . . . . . . . . . . . 162 3/C2
7.1 Conclusions.............................................. 162 3/C2
7.2 Recommendations ......................................... 163 3/C3
8.0 LITERATURE CITED ........................................ 166 3/C6

Table 32. Potential major primary impacts from operation of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 6) Surface Water (continued) | c) Elimination of the Walled Lake WWTP discharge would reduce beneficial low-flow augmentation in Walled Lake Branch, limiting aquatic biota and potentially lowering seasonal water levels in downstream lakes. | c) Same as A-1. | c) Same as A-1. | c) Increased discharge from the Walled Lake WWTP would increase flow in the Walled Lake Branch by as much as 380%, improving maintenance of downstream lake levels. | c) Same as C. | c) Maintenance of the Walled Lake WWTP discharge would continue to augment flow in the Walled Lake Branch, maintaining status quo conditions for water quality and aquatic biota. |
| | d) Elimination of an average total discharge of 3.1 mgd from Flat Rock and Rockwood WWTPs would reduce the Huron River flow by 6.5% during the 10-year, 7-day low-flow condition. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | d) Flow in the Huron River would not be reduced. |
| | e) Reduction of surcharging in the Flat Rock collection system may reduce basement flooding problems. | e) Same as A-1. | e) Same as A-1. | e) Same as A-1. | e) Same as A-1. | e) Same as A-1. |
| | f) At maximum design flow, the 49.2 mgd regional WWTP would discharge up to 12,300 pounds per day each of $BOD_5$ and SS, 5,130 pounds per day $NH_3$-N, and 615 pounds per day total phosphorus. This minimally would affect Lake Erie. | f) At maximum design flow, the 37.0 mgd regional WWTP would discharge up to 9,260 pounds per day each of $BOD_5$ and SS, 3,860 pounds per day of $NH_3$-N, and 463 pounds per day total phosphorus. This minimally would affect Lake Erie. | f) At maximum design flow, the 47.4 mgd regional WWTP would discharge up to 11,860 pounds per day of each $BOD_5$ and SS, 4,950 pounds per day $NH_3$-N, and 593 pounds per day total phosphorus. This minimally would affect Lake Erie. | f) At maximum design flow, the 43.0 mgd regional WWTP would discharge 10,760 pounds per day each of $BOD_5$ and SS, 4,485 pounds $NH_3$-N, and 540 pounds total phosphorus, which minimally would affect Lake Erie. Expanded discharge of up to 4.8 mgd from the Walled Lake WWTP would contribute maximum daily pollutant loadings during May-October of 160 pounds $BOD_5$, 400 pounds SS, 80 pounds $NH_3$-N, and 12 pounds total phosphorus; during the rest of the year, 400 pounds $BOD_5$, 600 pounds SS, 400 pounds $NH_3$-N, and 12 pounds total phosphorus. This would contribute to further reduction of downstream dissolved oxygen, possibly causing violations of State water quality standards. | f) At maximum design flow, the 32.0 mgd regional WWTP would discharge 8,000 pounds per day each of $BOD_5$ and SS, 3,380 pounds per day $NH_3$-N, and 400 pounds per day total phosphorus, which minimally would affect Lake Erie. Expanded discharge of up to 4.8 mgd from the Walled Lake WWTP would contribute maximum daily pollutant loadings during May-October of 160 pounds $BOD_5$, 400 pounds SS, 80 pounds $NH_3$-N, and 12 pounds total phosphorus; during the rest of the year, 400 pounds $BOD_5$, 600 pounds SS, 400 pounds $NH_3$-N, and 12 pounds total phosphorus. This would contribute to further reduction of downstream dissolved oxygen, possibly causing violations of State water quality standards. | f) At maximum design flow the 4.6 mgd Flat Rock, the 0.8 mgd Rockwood, and the 0.9 mgd Brownstown Township WWTPs would discharge a total of 785 pounds per day $BOD_5$, 1,020 pounds per day SS, and 55 pounds per day total phosphorus, which moderately would affect the lower Huron River. The 6.1 mgd W.C.-Trenton and 5.6 mgd Trenton WWTPs would discharge a total of 2,930 pounds per day each of $BOD_5$ and SS, and 98 pounds per day total phosphorus, which would affect the Detroit River minimally. Continued use of the 1.0 mgd Walled Lake WWTP would result in the generation of 55 pounds per day $BOD_5$, 35 pounds per day SS, and 8 pounds per day total phosphorus, which would affect the Walled Lake Branch moderately. Total phosphorus loading to Lake Erie would average 153 pounds per day at design flow. |
| | g) The maximum WWTP discharge of 49.2 mgd into the mouth of the Detroit River represents only 0.017% of the average flow of the river into Lake Erie. | g) The maximum WWTP discharge of 37.0 mgd into the mouth of the Detroit River represents only 0.012% of the average flow of the river into Lake Erie. | g) The maximum WWTP discharge of 47.4 mgd into the mouth of the Detroit River represents only 0.016% of the average flow of the river into Lake Erie. | g) The maximum WWTP discharge of 43.0 mgd into the mouth of the Detroit River represents only 0.015% of the average flow of the river into Lake Erie. | g) The maximum WWTP discharge of 32.0 mgd into the mouth of the Detroit River represents only 0.011% of the average flow of the river into Lake Erie. | g) The maximum WWTP discharge of 11.6 mgd (from the City of Trenton and Wayne County-Trenton facilities) into the Detroit River represents only 0.004% of the average flow of the river into Lake Erie. |
| | h) Potential operational failure at the regional WWTP would cause short-term violations of water quality standards but would have minimal long-term effects. | h) Same as A-1. | h) Same as A-1. | h) Same as A-1. | h) Same as A-1. | h) Potential operational failures at each of the six WWTPs would cause short-term violations of water quality standards in receiving waters and may limit their use. |
| | | | | | | i) Growth in excess of that projected in the service areas of the Trenton, Wayne County-Trenton, Flat Rock, and Rockwood WWTPs could be limited because of the lack of land to further expand WWTP capacities. (Permanent physical constraints adjacent to plant sites limit available property.) |

Table 32. Potential major primary impacts from operation of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 7) Groundwater | a) Increased use of sewers in the project area would eliminate reliance on septic systems and reduce the potential for groundwater pollution and aquifer recharge. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Limited sewer service would increase reliance on septic systems relative to the existing situation, especially in the central and northern parts of the project area (including Sumpter Township). |
| 8) Demography and Economics | a) Replacement of the six existing WWTPs by the regional WWTP would eliminate approximately 30 jobs at the treatment plants and create approximately 50 new jobs at the Brownstown Township plant. | a) Same as A-1, except that approximately 40 jobs would be created at the regional WWTP. | a) Same as A-1, except that approximately 40 jobs would be created at the regional WWTP. | a) Replacement of the five existing WWTPs by a regional WWTP would eliminate approximately 25 jobs at plant sites and create approximately 42 new jobs at the Brownstown Township site.<br>b) Approximately 9 additional jobs would be created at the expanded Walled Lake WWTP. | a) Same as C, except that approximately 30 new jobs would be created at the regional WWTP.<br>b) Same as C. | a) Expansion of the five existing WWTPs would increase the total number of jobs at all six plants to approximately 60. (Smaller WWTPs are more labor-intensive; thus more jobs are necessary to provide less service than are necessary for any other option.) |
| 9) Resource Use | a) Operation of the 49.2 mgd WWTP would consume over 55,000 kwh/day of electrical energy, 3,700 pounds per day of chlorine, and 2,300 gallons per day of ferric chloride. Other commitments include labor (see 8), other fuels and materials, and an estimated $4.6 million annually in operations costs. | a) Operation of the 37.0 mgd WWTP would consume over 42,000 kwh/day of electrical energy, 2,500 pounds per day of chlorine, and 1,700 gallons per day of liquid ferric chloride. Other commitments include labor (see 8), other fuels and materials, and an estimated $3.4 million annually in operations costs. | a) Operation of the 47.4 mgd WWTP would consume 52,000 kwh/day, 3,600 pounds per day of chlorine, and 1,950 gallons per day of liquid ferric chloride. Other commitments include labor (see 8), other fuels and materials, and an estimated $4.4 million annually in operations costs. | a) Operation of the 43.0 mgd regional WWTP and the 4.8 mgd Walled Lake WWTP would consume 61,000 kwh/day, 2,000 gallons per day of ferric chloride, 8 tons per day of lime, and 3,100 pounds per day of chlorine. Other commitments include labor (see 8), other fuels and materials and an estimated $4.8 million annually in operations costs. | a) Operation of the 32.0 mgd regional WWTP and the 4.8 mgd Walled Lake WWTP would consume 52,000 kwh/day, 1,500 gallons per day of ferric chloride. 8 tons per day of lime, and 2,500 pounds per day of chlorine. Other commitments include labor (see 8), other fuels and materials, and an estimated $4.0 million annually in operations costs. | a) Operation of six WWTPs would use more energy than would other alternatives:<br>WWTP — kwh/day<br>Walled Lake 7,000<br>Flat Rock 15,000<br>Rockwood 4,000<br>W.C.-Trenton 20,000<br>Trenton 17,000<br>Brownstown Twp. 6,000<br>69,000<br>Chemicals consumed daily for treatment include:<br>WWTP — Cl(lb) — $FeCl_3$(gal)<br>Walled Lake 60 50<br>Flat Rock 320 170<br>Rockwood 50 40<br>W.C.-Trenton 400 215<br>Trenton 370 230<br>Brownstown Twp. 55 45<br>1,255 750<br>Other commitments include labor (see 8), other fuels and materials, and an estimated $2.9 annually in operations costs. |

Table 32. Potential major primary impacts from operation of the HVWWCS (continued).

| Environmental Components | Alternative A-1 | Alternative A-2 | Alternative B | Alternative C | Alternative D | Alternative E |
|---|---|---|---|---|---|---|
| 10) Public Health | a) Widespread use of on-site septic systems in areas presently without sewers would be reduced, preventing potential contamination of soil, groundwater, and surface water. Documented problems in Sumpter Township would be relieved. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Continued widespread reliance on septic systems would increase potential for public health problems, especially where private wells are utilized. Documented health problems in Sumpter Township, and localized poor conditions in Commerce and White Lake Townships would persist. |
| | b) Wolverine Lake Village and White Lake Township would continue to rely on individual septic systems, increasing the potential for future localized development of health problems. | b) Same as A-1. | b) Wolverine Lake Village and White Lake Township would be served by the regional wastewater treatment system, reducing the potential for future localized development of health problems. | b) Wolverine Lake Village and White Lake Township would be served by the expanded Walled Lake WWTP, reducing the potential for future localized development of health problems. | b) Same as C. | b) Same as A-1. |
| | c) Water in proximity to the WWTP outfall sewer in the Detroit River could be hazardous for body contact recreation. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Same as A-1. | c) Waters in proximity to the outfall sewers from the six WWTPs could be hazardous for body contact recreation. |
| | d) Reduction of surcharging in the Flat Rock collection system would eliminate potentially unhealthful sewer backups into basements. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. | d) Same as A-1. |
| 11) Local Public Finance | a) The $4.6 million in annual operating costs for wastewater treatment would be borne entirely by local participants (see Section 6.2.2. for local shares). Local user fees would be increased by some unspecified amount. | a) Same as A-1, except that annual operation costs would be $3.4 million. | a) Same as A-1, except that annual operation costs would be $4.4 million. | a) Same as A-1, except that annual operation costs would be $4.8 million. | a) Same as A-1, except that annual operation costs would be $4.0 million. | a) Same as A-1, except that annual operation costs would be $2.9 million. |
| 12) Aesthetics | a) The WWTP at the Brownstown Township site will produce increases in ambient noise and odor levels. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Same as A-1. | a) Expanded operation at the Flat Rock, Rockwood, Wayne County-Trenton, and Trenton WWTPs in relatively urban settings would increase noise, odor, and visual impacts. |
| | | | | b) Expansion of the Walled Lake WWTP would create additional aesthetic impacts of a minimal nature at WWTP site area. | b) Same as C. | b) The Walled Lake WWTP would not be expanded. |

of wastewater treatment facilities by industries. To recoup these costs, communities which receive sewage system grants are required to establish an industrial cost recovery (ICR) system. Communities in the project area typically have not taken steps to levy charges on industrial users.

Under the requirements of the Clean Water Act (PL 95-217) and subsequent US-EPA regulations (40 CFR 35.905-6), industrial users which discharge 25,000 gallons per day or more of sanitary waste and/or process waste to the new system would be required to pay the full share of capital costs for the conveyance system and WWTP which they would utilize. They also must pay the associated share of annual O&M costs. No estimate of what this share would be is available. The local cost to individual users in communities would be lessened in proportion to the amount that industrial users pay.

The estimated per capita costs for each alternative are in Column 6 of Tables 26 through 31. The figures reflect annual costs based on the total projected 1985 population (the average situation) for each community for Alternatives A-2 through E. Per capita costs were not prepared for Alternative A-1 because 1985 population projections are not available in the Facility Plan. In the case of Alternatives A-2 through E, the figures show the relative amount that each citizen in a community would pay for the system if everyone were to share the costs (included for comparative purposes only).

Column 6 of Table 26, and column 7 of Tables 27 through 31 present the estimated average annual per capita costs for Alternatives A-1 through E based on peak-sewered population. In actuality, costs for each community would be borne only by residents who are provided sewer service, rather than by the total population. The peak year of sewered population is projected to vary from one community to another. Larger numbers of users than projected would tend to lower the figures somewhat, while lesser numbers would increase the per capita costs.

The last three columns (Columns 8, 9, and 10 of Tables 27 through 31) summarize the estimated impacts on the future debt situation of project area communities. (Equivalent values could not be produced for Alternative A-1 because of the population projection utilized.) The figures indicate expected changes in net debt per capita and in net debt as a percentage of SEV if a specific alternative is adopted. Net debt with full faith and credit pledge is calculated without taking into account that user charges probably would be used to pay most of the debt without resort to the tax base which supports the debt. Net debt is overstated somewhat because not all offsetting funds have been identified, such as user charges for sewer systems (Section 3.1.5.).

The alternatives vary considerably in terms of the populations which they serve. Alternatives B, C, and D would provide essentially all sections of the project area with wastewater treatment service. Alternative A serves a smaller area -- capacity is not provided for White Lake Township or Wolverine Lake Village. Alternative E only provides sewerage to limited areas. It is not possible, therefore, to make definitive comparisons of the alternatives based on the data in Tables 26 through 31.

A discussion of additional costs which are not reflected directly in capital expenditures and O&M was presented in Section 5. The inherent dissimilarities in these additional costs are important considerations when the alternatives are ranked based on direct costs. The analyses do not include such costs as abandonment of existing facilities, continued usage of the Rouge Valley and Downriver Disposal Systems, and the costs of new local sewers discussed in Section 5.3. The presentation is a relative comparison based on the best available information and estimates of expenditures, debt, and population.

As an example, based on the "Facility Planning Study for Sumpter Township" (Wade, Trim & Associates, Inc. 1977), total annual local costs for a new collection system in Sumpter Township would approach $0.9 million. This would cause Sumpter Township's total local share to approach $1.1 to $1.3 million annually if Alternatives A, B, C, or D were built. Users of potential new collection systems in White Lake and Commerce Townships, Wolverine Lake Village, and the unsewered parts of Novi, and the Townships of Northville, Plymouth, Canton, Van Buren, Huron, and Brownstown also would bear such costs. Communities in the urban, southern section of the project area already are developed to a great extent and have collection systems which generally are adequate to serve new growth. These communities thus would not have this additional financial burden.

An overall comparison of the costs of Alternatives A-2 through E is presented in Table 33. For each category, alternatives were ranked from 1 (highest cost) to 6 (lowest cost). If alternatives had the same costs, the sum of the appropriate ranks was divided equally between or among the alternatives. Composite ranking revealed Alternative C to be the most costly of the five alternatives, followed by Alternatives B, A-2, E, and D in descending order of expense. Alternative A-1 can not be compared directly in this manner because of the dissimilar population served, but ranks highest of the six alternatives in total cost.

A detailed discussion of the ramifications of the respective local costs for the various alternatives is presented in the following sections.

### 6.2.2.1. Alternative A-1.

Alternative A-1 has the largest total local cost of the various alternatives (Table 26). Commerce Township, Novi, Northville Township, Plymouth Township, Canton Township, Van Buren Township, and Trenton would have the highest annual costs because of their large capacity allocations. Trenton's $11.8 million annual share represents the largest local cost. Its $32 per sewered resident cost is also among the highest, along with Northville ($34) and Gibraltar ($32). Trenton, however, appears to have a sound financial status (Section 3.1.5.).

The lowest annual costs would be among the smallest users of the system: Romulus, Rockwood, and South Rockwood. These communities also have the lowest costs per sewered resident among the various participating communities.

Table 33. Comparison of the costs of Alternatives A-1 through E for the Huron Valley Wastewater Control System, Michigan. Ranks were assigned in each category as follows: 1 = most expensive alternative; 2 = next most expensive alternative; 3 = next most expensive alternative; 4 = next most expensive alternative; 5 = next most expensive alternative; and 6 = least expensive alternative.

| | ALTERNATIVE | | | | | |
|---|---|---|---|---|---|---|
| Category | A-1 | A-2 | B | C | D | E |
| Community Share of Total Local Capital Costs | 1 | 4 | 2 | 3 | 5 | 6 |
| Average Annual Cost of Amortization | 1 | 4 | 2 | 3 | 5 | 6 |
| Community Share of Average Annual Operation and Maintenance Costs | 2 | 5 | 3 | 1 | 4 | 6 |
| Total Average Annual Community Costs | 2 | 5 | 3 | 1 | 4 | 6 |
| Total Community Costs for the 20-Year Period | 2 | 5 | 3 | 1 | 4 | 6 |
| Estimated 1985 Average Annual Costs Per Capita | NC | 3 | 4 | 2 | 5 | 1 |
| Estimated Average Annual Costs Per Capita, Peak-Year of Sewered Population | NC | 3 | 4 | 2 | 5 | 1 |
| Estimated 1980 Net Debt Per Capita | NC | 2 | 3 | 4.5 | 4.5 | 1 |
| Estimated Increase in Net Debt Per Capita, 1977-1980 | NC | 1 | 2 | 3 | 4 | 5 |
| Estimated Net Debt as a Percentage of State Equalized Valuation (SEV) | NC | 1 | 3 | 5 | 3 | 3 |

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NC = Not Comparable

### 6.2.2.2. Alternative A-2

The effects of this alternative vary widely from community to community (Table 27). The highest estimated annual community costs would occur in Canton Township and Trenton. Although Canton Township would experience a slightly larger than average increase in net debt per capita (38%), it appears that figures for net debt per capita and net debt as a percentage of SEV would remain less than the average values for other project area communities ($943 and 11.4%).

The projected net debt per capita ($1,181) resulting from Trenton's participation in Alternative A-2 is not disproportionate for an economically-strong community and the net debt as a percentage of SEV (7.4%) also is relatively small. Because Trenton obtains a large percentage of its general revenue via property taxes (69%), it probably would be undesirable to depend on the tax base to finance Trenton's share of the project's capital costs.

Woodhaven's potential economic weakness was discussed in Section 3.1.5. The 1977 net debt per capita was $2,255, a substantially large amount according to Moak and Hillhouse (1975). Although the change in net debt per capita is small (+3%), Woodhaven's projected net debt per capita of $2,402 would be the largest in the project area. Alternative A-2 would increase the net debt as a percentage of SEV to 18.9% for Woodhaven, a value considerably in excess of the legal limit of 10% for cities in the State of Michigan. A legal problem, however, may not be created if a sufficient amount of the general obligation debt is offset by user charges. Woodhaven is not the only community which is projected to exceed the 10% legal limit for cities (e.g., Novi and Rockwood), but the margin by which it does so indicates a need for careful consideration of Woodhaven's position.

Walled Lake would experience the largest increase in net debt per capita (93%), but the resulting dollar level ($516) is considerably less than the project area average of $943 which is projected to result from implementation of Alternative A-2. Commerce Township also would have a substantial percentage increase (71%). The new level of per capita indebtedness ($714) is not especially high and is less than the average for project area communities. Neighboring Wolverine Lake Village and White Lake Township would not participate in Alternative A-2 and their financial situations are not analyzed.

Novi would experience a 15% increase in net debt per capita, with a projected 1980 figure of $1,007. This is slightly larger than the project area average but would not be excessive given Novi's apparent economic soundness (Section 3.1.5.). The anticipated 1980 net debt as a percentage of SEV (13.4) exceeds the 10% statutory limitation but could be offset by user charges.

Northville, Plymouth, and Plymouth Township would not require capacity in the new system by 1995 and would not be affected directly. Northville Township would participate and would experience a 7% increase in net debt per capita, with a 1980 estimated figure of $726. This would be slightly less than the project area average.

Basic data on many of the townships are incomplete (Section 3.1.5.). The discussions of the financial effects of Alternative A-2 on townships be less than the average of $856 for project area communities. Commerce Township would have a smaller increase in net debt per capita (36%) than would result from Alternative A-2. The amount of net debt per capita ($566) and net debt as a percentage of SEV would be less than average. Conditions in Novi would be similar to those likely to result from Alternative A-2.

Plymouth and Plymouth Township would require capacity in the new system and would have estimated annual average costs of $270,200 and $567,000, respectively. Debt ratios and amounts for the two communities would be close to the average value for the project area (11.0% and $856). Northville Township's costs and debt would be slightly larger under Alternative B, but still would be close to the average values for the overall project area.

The City of Northville would have a 17% increase in net debt per capita. While this would be less than average, the per capita cost would increase to $1,558. This would be the second largest amount of all communities in the system. Net debt as a percentage of SEV would be 18.8%, largest in the project area. Northville currently raises 36% of its general revenue via property taxes. It would appear that careful consideration should be given to the use of the tax base as support for the debt associated with Alternative B.

General impacts and comments on the Townships of Huron, Sumpter, Van Buren, and Brownstown would be similar to those for Alternative A-2. The same would be true for Gibraltar, Flat Rock, and Rockwood. Debt data for South Rockwood and Romulus were not calculated because of insufficiently detailed information.

Belleville would experience a 33% increase in net debt per capita. The new amount would be $476, one of the smallest values in the project area. Net debt as a percentage of SEV would increase to 14.2%, which would exceed the 10% limit for cities in the State of Michigan. This would require user charges to offset a sufficient amount of general obligation debt to avoid legal complications.

Estimates of annual sewered per capita costs required to pay for capital and O&M are shown in Column 7 of Table 28. The costs would be largest in Trenton and Gibraltar and smallest in South Rockwood, and Sumpter and Huron Townships. The same limitations apply to the analysis of Alternative B as were discussed in Section 6.2.2.

### 6.2.2.4. Alternative C

Impacts on community finances for Alternative C are summarized in Table 29. Impacts on Canton Township, Trenton, Woodhaven, Walled Lake, and White Lake Township would be similar to those of Alternative B. The percentage of increase in net debt for Walled Lake, White Lake Township, and Commerce Township would be reduced considerably. The effects on Novi and Northville would be the same as those of Alternative B.

Conditions in the remaining townships and municipalities would be similar to those resulting from implementation of Alternative B. Relative per sewered capita costs would be similar to those of Alternative B.

therefore are limited somewhat compared to the analyses of potential effects on project area cities. Huron Township is the only township whose net debt per capita ($1,208) is expected to be more than $1,000. Its net debt as a percentage of SEV is 19.4%. (The 10% law does not apply to townships.) Huron Township raises only 11% of its general revenue by property taxes, indicating a minor reliance on the SEV tax base. This would tend to offset the projected large ratio of net debt to SEV. Sumpter Township would have a larger than average increase in net debt per capita (68%), but the total ($591) would be less than average. Van Buren Township's projected net debt per capita and percentage of increase are close to project area averages. Its net debt as a percentage of SEV (14.5%) would be slightly larger than average. Brownstown Township's figures for net debt per capita and percentage increase are somewhat less than average, while its net debt/SEV ratio is slightly larger than average. The townships generally would not appear to demonstrate serious financial problems resulting from implementation of Alternative A-2.

Gibraltar and Flat Rock would have net debts per capita of about $1,000, increases of 25% and 30%, respectively. Net debt as a percentage of SEV is projected to be 9.1% and 6.5%, respectively, for the two communities. These percentages are less than project area averages. Income growth has been high for these two communities in comparison with other project area jurisdictions --a positive economic indicator.

Rockwood's net debt per capita is projected to remain low--less than $650. It would have to offset some of its general obligation debt with user charges to maintain a net debt/SEV ratio of less than 10%. Data for South Rockwood are incomplete and debt calculations were not made.

Belleville would not be a system participant. The small section of Romulus included in the project area would have one of the smallest average annual community costs because of the small amount of capacity required. Debt data were not calculated because of insufficient information.

The estimated annual sewered per capita costs required to pay for amortized capital costs and O&M are presented in Table 27. Gibraltar and Trenton would have the largest charges, and Commerce Township also would have an elevated rate ($37 per capita). Lowest rates probably would occur in South Rockwood, and Northville, Sumpter, and Huron Townships.

### 6.2.2.3. Alternative B

The financial effects of Alternative B are summarized in Table 28. Canton Township and Trenton again would have the largest annual community costs and the same general comments would apply as those presented in Section 6.2.2.2.

Woodhaven's net debt per capita would increase to $2,328--the largest in the project area. Impacts on this community would be similar to those of Alternative A-2.

The effects of Alternative B on Walled Lake also would be similar to those of Alternative A-2. Data on debt for Wolverine Lake were not available and no analyses were made. White Lake Township would experience a substantial increase in net debt per capita (52%), but the resulting amount ($593) would

### 6.2.2.5. Alternative D

This alternative would have impacts similar to those of Alternative C, except in the Plymouth-Northville area. A summary of estimated costs and debt is presented in Table 30. Novi, Northville, and Northville Township all would have very small increases in per capita net debt (1% to 7%) -- substantially less than in Alternative C. Northville and Northville Township would not have capacity in the new system and therefore would not have annual O&M costs. Capital costs in those two communities would result from construction incident to increased flows to the Rouge Valley Sewage Disposal District. Plymouth and Plymouth Township would not require capacity in the new system.

### 6.2.2.6. Alternative E

Alternative E would serve only limited sections of the project area. Large segments of the population would not be provided with public wastewater treatment service. Comparisons can be made only for communities served by the upgraded and expanded existing facilities. Data are summarized in Table 31.

Walled Lake would not require new capital expenditures and would not incur new debt related to this alternative. Operation and maintenance of the existing WWTP would be somewhat more expensive for Walled Lake and significantly more costly for Novi than if they joined a regional system.

Projections of debt for the section of the project area which includes Huron Township, Flat Rock, Rockwood, South Rockwood, Trenton, Woodhaven, Gibraltar, and Brownstown indicate that amounts and percentages would be somewhat smaller than for the previous five alternatives. Estimates of sewered per capita charges would be larger for most communities.

## 6.3. Secondary Impacts

Secondary impacts potentially caused by the implementation of one of the system alternatives would be the indirect or induced effects which would result in related land use and socioeconomic changes. These changes may be manifested by intensified population density and increased development in areas to be served by the proposed sewerage facilities; an increased rate of migration from the City of Detroit and its older suburbs to the project area; and eventually, by increased commercial and industrial development. As these changes occur, associated impacts would occur such as air and water pollution; increased ambient noise levels; increased consumption of energy and other resources; demand for expanded public infrastructure; conversion of agricultural lands, wetlands, and environmentally sensitive areas to other uses; decreased wildlife habitat; increases in employment and business activity; and increased property values.

Implementation of any one of the regional sewerage proposals contained in Alternatives A through D potentially could result in such changes in land use and socioeconomic characteristics. Alternative E, conversely, would constrain new development, limiting the potential for secondary impacts.

### 6.3.1. Indirect and Induced Growth

Public sewer service has been identified as a major factor contributing to the urbanization of an area (US-EPA 1975). In a review of current literature for US-EPA on the subject of secondary impacts of wastewater facilities, Fitzpatrick and others (1978) quoted Binkley (1975), "No single factor can be isolated as the cause of current land use practices...the role of interceptor sewers must, therefore, be seen as contributory rather than decisive". Furthermore, lack of public sewer investments does not necessarily stop further development; if development pressures are intense, private sewerage systems can become financially feasible (i.e., individual septic tanks, package treatment plants). Thus, "development can continue unchecked without public investment in sewer facilities, but the form, intensity, and rate of development may be significantly altered" (US-EPA 1975). The report concluded that the limited empirical analyses available suggest that sewerage systems cannot always be isolated as instrumental causes of development. However, under a set of limited conditions not uncommon today, they may serve as a "principal stimulus" for localized development (Fitzpatrick and others 1978).

"The national urban policy announced on March 27, 1978, identified sewer construction in undeveloped areas on a major contributor to urban problems. Under the policy, the Environmental Protection Agency must implement its water and sewer programs in a manner which will discourage wasteful sprawl.

Large sections of open, undeveloped land currently exist in the project area, especially in the western tier of townships. Much of the project area, with the exception of Commerce and White Lake Townships, has excellent highways and access to major airports. In addition, employment levels generally have been higher in the project area than in nearby localities. These factors seem to indicate that new sewerage facilities could have major impacts on growth.

Statements presented by local officials of various project area communities at public information meetings during the preparation of the EIS indicate that strong competition for growth exists among project area communities. Because many of these communities have similar prospects for growth, the provision of differential sewer service among communities may provide a competitive advantage.

It also is possible that new growth may bypass some communities, resulting in a scattered pattern of development. The north-south orientation of the interceptor in the western townships, combined with the similar alignment of Interstate 275, may induce a long, narrow corridor of built-up land with nodal development near highway interchanges.

Some sections of the project area, such as parts of White Lake, Commerce, and Sumpter Townships have conditions which either are totally unacceptable for utilization of septic systems or which would require a significant investment by a homeowner (up to $5,000) to make such a system useable. In such areas, growth would be limited altogether or constrained to larger lot-sizes to accomodate septic tanks and drain fields unless sewer service could be provided.

### 6.3.2. Impacts of Induced Growth

The impacts from growth which may be induced by the provision of wastewater facilities (as proposed in Alternatives A through D) in undeveloped parts of the project area may be of more consequence than many of the direct project impacts. Construction activities and the resulting urbanization of large amounts of undeveloped land in the project area would impact air and water quality, convert large amounts of undeveloped lands to developed uses, consume resources, and change the socioeconomic character of the area (Fitzpatrick and others 1978).

Specific types of impacts which may be expected are listed in Table 34. Because the level of secondary growth which may be induced by the implementation of any one of the alternatives is not quantifiable, it similarly is not possible to quantify the extent of secondary impacts. Table 34 therefore provides qualitative information indicating the relative levels of secondary effects of each alternative.

## 6.4. Minimization of Adverse Impacts

There are a variety of legal requirements and other measures which are intended to alleviate adverse impacts from projects such as the Huron Valley Wastewater Control System. To the extent that these measures are applied, many adverse impacts can be reduced significantly or eliminated. The following sections discuss potential measures for alleviating construction, operation, and secondary impacts.

### 6.4.1. Minimization of Construction Impacts

The majority of potential primary construction impacts, as discussed in Section 6.1., relate to the construction of the regional interceptor proposed in Alternatives A through D. Many of the potential measures to minimize adverse effects discussed in the following section relate to interceptor impacts. Most measures also are applicable to construction at WWTP sites, such as the proposed regional WWTP in Alternatives A-1 through D, or at the smaller plants in Alternative E.

Fugitive dust at the construction sites described for each of the alternatives can be controlled through various techniques. Spoil-piles and unpaved access roads can be wetted periodically to reduce dust; alternatively spoil-piles can be covered with matting, mulch, etc. to reduce susceptibility to wind-erosion.

Street sweeping at access sites would reduce loose dirt which is "tracked" onto roadways by construction equipment. Trucks hauling spoil from tunnel access sites could cover their loads to eliminate the escape of dust while in transit to disposal sites.

Proper maintenance of construction equipment would minimize emissions of hydrocarbons and fumes. Soil borings along the proposed interceptor right-of-way (ROW) during the "Step II" design phase would identify organic soils which have the potential to release odors when excavated. These areas should be bypassed.

**Table 34. Potential secondary impacts from development induced by the Huron Valley Wastewater Control System, Michigan.**

| MAJOR CATEGORIES OF IMPACTS | ALTERNATIVE A-1 | ALTERNATIVE A-2 | ALTERNATIVE B | ALTERNATIVE C | ALTERNATIVE D | ALTERNATIVE E |
|---|---|---|---|---|---|---|
| Short-term effects from construction activities related to increased development in the project area:<br>• Emission of dust, hydrocarbons, and noise from construction sites would degrade local air quality.<br>• Runoff would increase sediment loads to surface waters, increasing turbidity and adversely affecting aquatic biota.<br>• Unprotected cultural, historic, and archaeological sites may be sacrificed to accommodate development.<br>• Capital, labor, energy, land, and materials would be committed irretrievably.<br>Long-term effects from increased urbanization:<br>• Degradation of ambient air quality and greater noise from an increased number of fixed and mobile sources.<br>• Modification of productive soils and local topography.<br>• Windfall profits for some property owners and speculators from land sales.<br>• Loss of biological and economic productivity from destruction of natural vegetation, wetlands, wildlife habitat, and agricultural lands.<br>• Reduction in infiltration would preclude groundwater recharge; increased runoff would degrade surface waters.<br>• Increased local employment and income.<br>• Significant expansion of public services, with a consequent need for increased public revenues (i.e., increased property taxes, user fees, etc.).<br>• Expansion of local tax base.<br>• Changes in long-term energy requirements resulting from commuting patterns, housing location, and density of new development.<br>• Loss of population from existing urban areas (especially Detroit) through migration to the project area, resulting in inefficient utilization of existing infrastructure.<br>• Degradation of aesthetic values through the conversion of attractive natural features and decrease in the extent of open space. | Has the greatest potential for generating short-term impacts and sustaining long-term impacts in Commerce, Northville, Plymouth, Sumpter and Huron Townships, and the Cities of Novi, Walled Lake, Flat Rock, Rockwood, Woodhaven, Trenton, and Gibraltar through provision of the largest interceptor capacity to these communities. Wetland/lake areas of Commerce Township especially would be susceptible to water-related impacts. The five townships listed presently have the most undeveloped area and would undergo the most significant changes because of growth. Lack of service to White Lake Township and Wolverine Lake Village could constrain growth, thus precluding secondary impacts.<br>Based on qualitative data, this alternative has the most potential for increased development and urbanization. | Overall, would have a lesser potential for generating impacts than Alternative A-1, because of the reduced capacity of the system. Larger capacities, however, would be provided to Northville and the Townships of Canton, Van Buren, and Brownstown than in A-1, increasing the relative potential for impacts. Both Canton and Van Buren Townships currently have extensive undeveloped areas in agricultural use which potentially could be usurped by development.<br>Alternatives A-1 and B have more potential for secondary impacts. Alternative C has slightly less potential for secondary impacts. | Provides the same amount of capacity for communities served in Alternative A-2 (see Section 5.3.), but also extends service to White Lake Township, Wolverine Lake, and Belleville. Thus, Alternative B would expand the geographic area in which secondary impacts potentially could be created relative to A-1 and A-2. The total capacity of the system, however, is less than A-1.<br>Only Alternative A-1 has more potential for secondary impacts. | Because the same interceptor capacity is provided in Alternative C as in Alternative B, the same general potential for secondary impacts would exist. It is possible, however, that the relatively higher annual costs for users in White Lake and Commerce Townships of an expanded Walled Lake WWTP could tend to decrease the attractiveness of the service, and thus reduce growth and related impacts somewhat relative to B.<br>Alternatives D and E have less potential for secondary impacts. Alternative A-2 has slightly more potential for secondary impacts. | Would create the same potential for effects as Alternatives A-2, B, and C in the southern part of the project area (as far north as Canton Township) and the same as C in the White Lake-Commerce Township area. Without the availability of the Hannan Road interceptor service in the Plymouth-Northville-Novi area, growth and its impacts would be somewhat less than in A-1, A-2, B, and C, due to the prospect of reduced future reserve capacity.<br>Alternative D has the least potential for secondary impacts of the five regional alternatives. | Would constrain growth relative to the other five regional alternatives. Projected population levels for the project area (Section 3.1.2.) may not be attained. Instead of impacts related to induced growth, communities without adequate new interceptor system capacity may decline in population. This may include loss of industrial growth prospects, relatively decreased economic prosperity, and a decreased local tax base. This alternative would have the least potential to encourage out-migration from Detroit. It would result in the least amount of conversion of natural areas and agricultural lands to developed uses, sustaining a more rural lifestyle in the undeveloped parts of the project area.<br>Based on qualitative data, this alternative has the potential for long-term secondary impacts which could surpass those of Alternative A-1. |

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Construction noise would be difficult to reduce along the interceptor route. Therefore, the route chosen should attempt to avoid sensitive areas such as hospitals, schools, and residential areas. Routing the interceptor along primary traffic arteries would lessen the relative noise impact, but may increase traffic congestion. Tunneling could substantially lessen noise impacts and should be considered in noise sensitive areas.

Spoil disposal sites should be identified during the project design stage ("Step II") to ensure that adequate sites are available and that disposal site impacts are minimized. Plans for landscaping and restoration immediately after disposal is completed should be included as an integral part of system design.

Lands disturbed by trenching for interceptor emplacement and tunnel access areas should be regraded, compacted as necessary to prevent future subsidence of the fill, and revegetated as soon after construction as possible. If appropriate, natural vegetation should be favored. Regardless, native plants should be used. This would facilitate establishment of wildlife habitat.

The final interceptor route design should attempt to avoid wetlands. The dewatering of trenches and tunnel segments during construction should be monitored to minimize drawdown effects on the surrounding water table, especially in wetland areas. Recirculation of withdrawn water to the wetland could lessen the possibility of desiccation and plant mortality. Return-water must be of acceptable quality--highly mineralized water could affect wetland vegetation adversely.

The number of stream crossings should be minimized in the final route design. Several of the numerous interceptor crossings of the Lower Huron River might be avoidable through interceptor realignment without increasing the project cost substantially. Regardless, Section 10 (Rivers and Harbors Act of 1899) and/or Section 404 (PL 92-500) permits will be required from the US Corps of Engineers for all stream crossings.

Where crossings are necessary, careful planning could minimize adverse effects. This includes scheduling crossing construction during the low-flow condition, usually during late summer. Some project area waterways are dry at that time and would be unlikely to transport sediment loads downstream. Potentially erodible bank-cuts must be re-stabilized concurrently before a storm event could again create flow conditions capable of transporting sediment loads for substantial distances downstream. Where significant stream flow would be encountered, such as in crossing the Lower Huron River, temporary diversion channels with artificially stabilized banks or large culverts should be used to minimize the potential for erosion.

Where soils are exposed by open-trench excavation, by clearing WWTP sites, or at tunnel access areas, measures must be taken to minimize erosion. The Michigan Erosion and Sedimentation Control Act of 1972 (Act No. 347) and US-EPA's Program Requirements Memorandum 78-1(1977) establish requirements for control of erosion and runoff from construction activities.

Adherence to these requirements would serve to mitigate potential problems to a large extent. The requirements include:

- Construction site selection should consider potential occurrence of erosion and sediment losses
- The project plan and layout should be designed to fit the local topography and soil conditions
- When appropriate, land grading and excavating should be kept at a minimum to reduce the possibility of creating runoff and erosion problems which require extensive control measures
- Whenever possible, topsoil should be removed and stockpiled before grading begins
- Land exposure should be minimized in terms of area and time
- Exposed areas subject to erosion should be covered as quickly as possible by means of mulching or vegetation
- Natural vegetation should be retained whenever feasible
- Appropriate structural or agronomic practices to control runoff and sedimentation should be provided during and after construction
- Early completion of stabilized drainage system (temporary and permanent systems) will substantially reduce erosion potential
- Access roadways and tunnel staging areas should be paved or otherwise stabilized as soon as feasible
- Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with the grading and clearing activity.

Parklands and cemeteries should be avoided in final route design. Where these areas cannot be avoided, tunneling should be considered to minimize surface disruption. Trenching through parks, from a cost perspective, should be scheduled for the off-season, avoiding conflicts with peak summer recreation demand. The entire interceptor ROW should be reclaimed immediately after construction to minimize adverse aesthetic impact as well as the other types of impacts discussed. As a public ROW, the route could be considered as a public "trail" for walking, biking, or horse paths.

Planning of routes for heavy construction equipment should ensure that surface load restrictions are considered, avoiding damage to streets and roadways. Trucks hauling tunnel-spoil from access areas to disposal sites should be routed along primary arteries to minimize the threat to public safety. Special care should be taken to minimize disruption of access to commercial establishments, parks, and other frequently visited sites/areas.

Construction sites, equipment storage areas, and tunnel access areas, should be fenced to restrict entry and to prevent accidents. Traffic control would be needed at points where construction equipment would enter onto public streets. This would reduce the potential for accidents. Announcements should be published in newspapers and broadcast through other news media to alert drivers of temporary closings of primary traffic routes during interceptor construction. Emergency service organizations should be alerted to prevent interruption of prompt delivery of services.

The National Historic Preservation Act of 1966, Executive Order 11593, the Archaeological and Historic Preservation Act of 1974, and the 1973 Procedures of the Advisory Council on Historic Preservation require that care must be taken early in the planning process to identify cultural resources and minimize adverse effects on them. US-EPA's final regulations for the preparation of EISs (40 FR 16818) also specify that compliance with these regulations is required when a Federally funded, licensed, or permitted project is undertaken. Due to the lack of adequate information on existing archaeological resources in the project area, it may be necessary to conduct on-foot surveys (conducted by professional archaeologists) of the interceptor ROW, especially in areas of high site potential (Figure 6). In addition, it may be necessary to provide archaeological expertise during construction in critical areas to avoid destruction of archaeological resources. If not already identified, project delays due to involvement with discovered archaeological sites would be costly. For this reason, adequate ground coverage surveys during the planning period are advisable. Consultation with the State Historic Preservation Officer (SHPO) should be undertaken concerning cultural resources before the commitment of capital for project construction.

Project costs could be lessened to an extent through construction of a smaller, less costly system. Alternative E offers the minimum project cost, though it does not meet other project area needs. Optimizing use of existing capacity in the RVSDD and DD systems would reduce the expenditure for new capacity. A smaller system also would commit smaller amounts of other irretrievable resources, such as energy, materials, and labor.

### 6.4.2. Mitigation of Operation Impacts

Most potentially adverse operational aspects of the various system alternatives relate to the discharge of treated effluent to project area waterways (Section 6.2.). Measures to minimize WWTP discharge impacts proposed in each system alternative considered in Section 5.3. are discussed below.

Gaseous emissions and odors from various WWTP processes can be controlled to a large extent through proper plant operation procedures. Additionally, in the case of the regional WWTP to be sited in southern Brownstown Township (Alternative A-1 through D), a buffer zone could be established beyond which emissions and odors would be relatively undetectable. Such a buffer zone, consisting of trees and shrubs also would serve to reduce noise transmitted from the plant site and would help maintain the existing aesthetics on part of the site area.

Emissions from proposed sludge incinerators would be regulated by the US-EPA's New Source Performance Standards. These standards limit discharge of particulate matter from sludge incinerators to 1.30 pounds per ton dry sludge input (US-EPA 1975). In addition, incinerator emissions must remain in compliance with the National Ambient Air Quality Standards (US-EPA 1971) for the various primary pollutants. Potential odor formation from incineration can be prevented through proper operational procedures.

Temporary incinerator ash storage on-site should be in an enclosed area and ash should be transported in covered trucks to disposal sites. Proper landfilling techniques should be practiced at the disposal site to prevent wind dispersal of the ash.

An NPDES permit would be required from the MDNR prior to the discharge of effluent from any of the WWTPs proposed in the various system alternatives. The discharge permit would specify discharge quality (Section 5.2.4.) and would require daily monitoring of the effluent. Periodic plant inspections would be conducted by the MDNR. If the conditions of the permit were violated, enforcement action would be taken against the management agency to ensure compliance.

Federal Guidelines for Design, Operation, and Maintenance of Wastewater Treatment Facilities (USDI 1970) require that:

> *All water pollution control facilities should be planned and designed so as to provide for maximum reliability at all times. The facility should be capable of operating satisfactorily during power failures, flooding, peak loads, equipment failure, and maintenance shutdowns.*

The wastewater control system design for the project area should consider the following types of factors during the "Step II" phase of the Construction Grants process to ensure system reliability (after USDI 1970):

- Duplicate sources of electric power
- Standby power for essential plant elements
- Multiple units and equipment to provide maximum flexibility in operation
- Replacement parts readily available
- Holding tanks or basins to provide for emergency storage of overflow and adequate pump-back facilities
- Flexibility of piping and pumping facilities to permit rerouting of flows under emergency conditions
- Provision for emergency storage or disposal of sludge
- Dual chlorination units
- Automatic controls to regulate and record chlorine residuals
- Automatic alarm systems to warn of high water, power failure, or equipment malfunction
- No treatment plant or upstream by-passes
- Design of interceptor to permit emergency storage without causing back-ups
- Enforcement of pretreatment regulations to avoid industrial waste-induced treatment upsets
- Flood-proofing of treatment plant
- Plant Operations and Maintenance Manual to have section on emergency operation procedures
- Utilize highly qualified plant operators.

Through the incorporation of these types of factors in the design and operation of the wastewater control system for the Huron Valley project area, the system will be virtually "fail-safe". This is necessary to ensure that effluent standards will be met during the system's entire design life. These factors can be applied more economically to the design of larger WWTPs, such as the regional WWTPs proposed in Alternatives A-1, A-2, B, C, and D, than to the small plants proposed in Alternative E.

Phosphorus concentrations, as well as concentrations of other parameters, can be reduced further in the WWTPs effluent through application of advanced treatment processes. The extremely high relative cost of providing tertiary treatment must be compared with the benefits derived to ensure that unnecessary cost burdens are not imposed. The MDNR has determined that expansion of the existing WWTPs which discharge to the Lower Huron River (Flat Rock, Rockwood, and Southern Brownstown) as proposed in Alternative E would require tertiary treatment (Section 5.2.4.). The benefit of requiring tertiary treatment of wastewater discharged to the Detroit River (from a potential new WWTP to replace the Wayne County-Trenton WWTP and from the Trenton WWTP) or from the proposed regional WWTP with discharge to Lake Erie, would only marginally improve water quality. (The assimilative capacity of these waters is exceptionally great.) Reduction of effluent phosphorus to less than 1.0 mg/l would be a desirable goal in terms of the effort to reduce the rate of eutrophication of Lake Erie, if its cost-effectiveness could be proven.

Severe adverse impacts which would occur in the WWTP outfall mixing zone in Lake Erie, could be reduced through modification of the design of the outfall structure, the discharge could be diffused, improving mixing. This would eliminate the "slug" discharge effect.

Most employees who would lose their jobs through the abandonment of existing WWTPs in the project area probably could find employment at the new regional plant. Because of the long distance between the Walled Lake WWTP and the regional plant site in southern Brownstown Township, plant operators from Walled Lake probably would have to relocate.

Problems with existing septic systems, especially in Sumpter, Commerce, and White Lake Townships, which would not be alleviated under Alternative E, could possibly be improved through establishment of public septic system maintenance districts. Through this mechanism, adequate maintenance of existing systems and identification of failing systems for repair potentially could relieve problems in many cases. Enforcement of county health ordinances also would preclude future problems with new systems. A public water supply system in Sumpter Township in place of individual private supplies would eliminate the potential for contaminated water supplies caused by failing septic systems in the township.

Energy and materials consumption related to construction and operation of proposed sewage sludge incineration facilities at WWTPs proposed in the various alternatives could be precluded if sites could be found for land application of sludge. Knowledge of the chemical content of the sludge would be required to determine suitability for application and application rates. Pretreatment of industrial wastes to remove toxic materials should prevent the accumulation of toxic substances in WWTP sludge, allowing it to be suitable for agricultural application. In this way, the nutrients contained in the sludge are recycled instead of requiring energy to dispose of them through incineration.

### 6.4.3. Minimization of Secondary Impacts

Secondary impacts from growth induced by system construction (Alternatives A-1 through D - Section 6.3.) largely can be reduced through coordinated growth management planning. Communities in the project area each have zoning ordinances which provide them the legal means to regulate the general location, density, and type of growth. This should be coordinated throughout the project area through County planning agencies and by SEMCOG to ensure regional needs also are considered.

Through the application of growth management controls, new growth can be located in centralized areas so as to facilitate efficient delivery of public services. Planning for streets and roads, public utilities, schools, hospitals, parks, and industrial areas is already underway in most communities and must be capable of preventing problems associated with sprawl.

Application of the general types of construction impact control measures as described in Section 6.4.1. would help reduce potential short-term air quality, noise, and water quality problems. Local requirements for retention of storm runoff from large parking lots and other large impervious areas to promote infiltration would lessen the impact of runoff on receiving waters.

## 6.5. Unavoidable Adverse Impacts

There is a general amount of short-term disruption associated with major construction projects as proposed in Alternatives A-1 through E which cannot be avoided. Construction activities produce noise, and in areas where no alternative route can be found to minimize noise impacts, nuisance conditions would exist. The proposed construction activities also would degrade the aesthetic quality of an area for the duration of construction. Heavy equipment is integral to construction and must have access to and from the site areas. Traffic congestion may be created. These impacts must be tolerated for the duration of construction.

Any system alternative which proposes a public wastewater control system where collected wastewater cannot be applied to land for treatment and/or disposal must discharge treated wastewater to a receiving water. The affect the discharge has on the quality of the receiving water is regulated by the plant's discharge permit (Section 6.4.2.). There will be some effect in the mixing zone and some lesser effect downstream. This effect traditionally has been considered acceptable when the economics of wastewater treatment are considered.

The minimal increase in background noise and odor levels not eliminated through the use of a buffer zone at the proposed WWTP sites would be a residual effect of plant operation. Wastewater treatment by its very nature, produces large quantities of biologically and chemically unstabilized solid waste which must be disposed of in some manner. Although the impacts can be reduced, the requirement for disposal cannot be avoided.

The construction and operation of the HVWWCS will cost a considerable amount of money and consume a significant amount of the resources (Section 6.1. and 6.2.). Although the size of the system may be reduced to lessen the impact, some significant amount of resources must be committed to provide the needed level of service. The construction of a smaller system also may require construction of additional capacity in the future. The impacts resulting from growth induced by interceptor construction may be reducible as discussed in Section 6.4., but are not avoidable. Similarly the impacts from abandonment of existing public infrastructure in Detroit as the result of continued or increased out-migration to the project area would be unavoidable.

## 6.6. Irretrievable and Irreversible Resource Commitments

The major types and amounts of resources which would be committed through the implementation of any of the six alternatives are presented in Sections 6.1. and 6.2. These include public capital, energy, land, labor, and unsalvageable materials. For each alternative, there is a significant consumption of these resources with no feasible means of recovery. Thus, non-recoverable resources would be foregone for the provision of the proposed wastewater control system.

Growth which may be induced in the project area through provision of a large capacity wastewater control system would irretrievably convert productive agricultural lands, wildlife habitat, and open-space to urban uses. Such an action would permanently impair the food and wildlife production capability of the area.

Accidents which could occur from system construction and operation could cause irreversible bodily damage or death, and damage or destroy equipment and other resources. Unmitigated treatment plant failure potentially could kill aquatic life in the immediate mixing zone.

The continued discharge of nutrients, especially phosphorus, to Lake Erie by the WWTPs in the various alternatives would hasten the eutrophication of Lake Erie. While this effect can be slowed through remedial actions in the future, it cannot be entirely reversed.

The potential accidental destruction of undiscovered archaeological sites through excavation activities is not reversible. This would represent permanent loss of the site.

Once communities sign contracts to participate in the construction of a regional wastewater control system, the legal constraints as well as the large commitment of public funds would preclude future community options for an alternative system. While this is not a permanent commitment, it is a long-term commitment relative to commitments for many other public services.

## 6.7. Relationship Between Short-term Uses of Man's Environment and Maintenance and Enhancement of Long-term Productivity

The provision of a regionalized wastewater control system in the project area would irretrievably commit resources for short-term use--the next 40 to 50 years. The growth which would be facilitated through the provision of the HVWWCS would destroy for the long-term productive agricultural lands, wildlife habitat, and open-space.

Short-term nuisance conditions from construction activities would be incurred to provide longer-term wastewater control service. The investment in non-recoverable resources committed to project construction and operation would be traded-off for the amount of public service provided for the life of the system (40 to 50 years). Long-term improvements in water quality from improvement of municipal discharges and elimination of septic systems also would be derived from the short-term investment.

If continued out-migration of residents from Detroit and its older suburbs to the project area is stimulated through the provision of the HVWWCS, then the short-term decision to implement the system would contribute to the long-term decline of the City of Detroit. As discussed in Section 6.3., abandonment of existing public infrastructure in Detroit and the creation of new, duplicate infrastructure in the project area is a long-term waste of resources.

## 7.0. CONCLUSIONS AND RECOMMENDATIONS

### 7.1. Conclusions

There is an immediate need for new wastewater facilities to relieve the overloaded Flat Rock WWTP, and to bring the Rockwood WWTP, the Wayne County-Trenton WWTP, and the Brownstown Township lagoons into compliance with the discharge limitations required by their operating permits. In addition, the potentially hazardous health situation which exists in Sumpter Township from malfunctioning and in some instances inoperable septic systems must be remedied. Excessive I/I creates wet-weather flows which exceed the treatment capacity of the Wayne County-Trenton WWTP. This results in plant flooding and in the discharge to the Detroit River of effluent which has received only partial treatment.

Service to project area communities in the RVSDD is hampered by I/I throughout the system and combined sewer flows in the eastern section of the district. Overloads frequently occur during periods of wet weather. Studies currently are being conducted to determine whether the Detroit WWTP will have adequate capacity to meet the sanitary sewer service needs of its present customers. The Detroit facility may have sufficient capacity to handle additional future flows from its current service area. Flow equalization techniques can reduce the required capacity of interceptors. An example is the use of an equalization basin by the City of Novi.

Data are not available on the magnitude and composition of industrial wastewater contributions to municipal treatment systems. The total cost and impacts of the expanded and upgraded collector sewer systems required for wastewater management within the project area are unknown. Based on information presented in this EIS (Section 3.4.), no immediate need exists for a new wastewater management system in the northern section of the project area (north of Novi).

The large capacity provided by a regional system (especially Alternatives A-1, A-2, B, and C) in an area with extensive undeveloped land could induce significant development. The population of the City of Detroit has been decreasing since 1950. Available data indicate that the rate of out-migration has been increasing. Industry has moved into suburban areas, where land is less expensive than in the city and where good transportation is available. If the rate of out-migration from the City of Detroit is maintained or accelerated by the availability of regional sewer service, the Federal Government would have committed significant funds to a project which is contrary to the national urban policy (see Section 6.3.).

Implementation of a large, expensive regional wastewater treatment system would require significant expenditures by governmental units in the project area. The potential impact would vary from community to community (Sections 6.1.2. and 6.2.2.). It is questionable whether some project area jurisdictions, most notably Woodhaven, could bear the burden of large capital and O&M expenditures. If user charges are not sufficient to pay all the costs of construction and operation of a new system, the necessary monies will have to be obtained by special assessments or by increased tax rates. The willingness of local residents to accept new debt and potentially increased taxation is uncertain, especially in light of the so-called "taxpayers' revolt" in the

State of California and subsequent local initiatives throughout the country.

Emplacement of an interceptor for Alternatives A-1, A-2, B, C, and D will have a significant potential for the disturbance and/or destruction of archaeological sites in the project area. Construction activities also may interfere with public use of local recreational facilities, especially in the Lower Huron, Willow, and Oakwoods Metroparks.

Alternatives A-1, A-2, and B provide for regional interceptor construction in, and treatment capacity for, the section of the project area north of Novi. Because the need for such a system has not been demonstrated and because of the potential primary and secondary impacts of these alternatives (Tables 25, 32, and 34 respectively), these alternatives are eliminated from further consideration.

If continued use of the RVSDD is an integral part of system design, then Alternative C would result in the provision of excess capacity (as would Alternatives A-1, A-2, and B). This would not be cost-effective and therefore this alternative is rejected.

Alternative E would not meet the water quality management or sewer service needs of the project area. Although this alternative may appear to be the least costly, the direct costs of Alternative E cannot be compared equitably with the other alternatives (Section 5.3.5.). Alternative E would not serve large segments of the existing project area population and has no provision for anticipated future growth. Operation of a system utilizing six WWTPs raises serious questions regarding reliability. It is likely that more frequent plant overloads and failures would occur than in a system with one or two WWTPs. Although the volume of untreated wastewater probably would be smaller per incident, the impacts could be severe, especially for raw sewage discharges to the Huron River and the Middle River Rouge. Alternative E could lead to a proliferation of small WWTPs in developing areas of southeast Michigan. Such a system could result in significant water quality problems and large capital expenditures. Alternative E therefore is rejected.

Alternative D is the most cost-effective, reliable, and efficient solution to the wastewater management needs of the project area through 1995. The regional interceptor would extend only as far north as Canton Township, would maximize the use of existing interceptors, and would minimize primary and secondary impacts. Alternative D therefore should be implemented.

### 7.2. Recommendations

Alternative D has been selected as the recommended action. Although problems with individual on-site wastewater disposal systems have been reported from the Oakland County part of the project area (Section 3.4.9.), no detailed data are available to document the extent of groundwater or surface water degradation. In view of the lack of a demonstrated immediate need for a new wastewater control system in the northern section of the project area, action to expand the Walled Lake WWTP should be deferred until such time as facility plans and/or other studies are completed for the Commerce Township-White Lake Township area. Careful consideration should be given to the possibility of land application of wastewater to treat future flows which exceed the design capacity of the existing Walled Lake facility. The possibility of connecting these communities to the proposed West Arm of Detroit's North Interceptor should be studied. The establishment of a public septic system maintenance district in White Lake and Commerce Townships could help to ensure that private septic systems are maintained properly.

Results of I/I studies should be incorporated into the recommended alternative. Sewer system evaluation surveys need to be completed and the results should be integrated into system design. Detailed information on the need for local collector sewer systems and specific cost estimates should be prepared. The potential for overloading the Middle and Lower Rouge Interceptors with flows from communities in the Huron Valley project area must be determined. Plans to accomodate such overloads must be developed.

The shares of system construction and operation costs borne by industrial users (as required by Federal regulations -- 39 FR 5261) should be determined. This would provide participating communities with a more realistic estimate of their shares of system costs.

The initial stages of engineering design (Step II) for the HVWWCS should be started as soon as possible in the southern part of the project area (through Canton Township -- Alternative D). These stages include the aerial photography, soil analyses, preliminary route surveying, and archaeological surveys. Sewer system evaluation surveys, rehabilitation work, and local facility planning for expanded service areas should proceed concurrently. Based on this information, the capacity and northern terminus of the interceptor could be determined without significant delay of design. (Delays in start-up of project construction are extremely expensive in terms of inflated costs and continued degradation of water quality.)

Local facility plans also should investigate alternatives for local wastewater management which are independent of the proposed HVWWCS. (The Facility Plan previously prepared for Sumpter Township only considered alternatives which are dependent on the HVWWCS.) These studies would provide information early in the "Step II" design phase of the HVWWCS and would allow communities which can develop more cost-effective local systems to drop out of the regional system before design is completed. This would help minimize the need for system re-design caused by future community decisions to not participate in the regional system.

Another important reason for concurrent local facility planning is illustrated by the conclusions contained in the Facility Plan completed for Sumpter Township. It was determined that the proposed Sumpter-Van Buren Arm of the regional interceptor (Alternatives A-1 through D) is not needed for Sumpter Township. Further, it is stated in the Facility Plan that the interceptor appears to be unwarrented in Van Buren Township as well. Facilities plans which identify adequate local collection systems and accurate projected flows are integral to the design of a cost-effective regional wastewater control system.

Detailed estimates of the costs for the participation of each community should be developed. Each community then should evaluate the impact of participation on its ability to undertake new debt. Considerations in the analyses should include present debt and tax levels, commitments for other future expenditures, and similar issues. This will aid communities in their decisions regarding participation in the HVWWCS.

A thorough archaeological literature review and assessment of the conceptual route of the regional interceptor should be conducted as soon as possible. The survey should be carried out by a professional archaeologist and the efforts should be coordinated with the State Historic Preservation Officer (SHPO). These efforts should be completed prior to final route design so as to permit any required changes in the route of the interceptor. Construction activities should be monitored closely. Excavation should cease immediately if artifacts are encountered and the SHPO should be notified at once.

The route of the regional interceptor should avoid crossing parkland and recreational areas to the maximum extent. Where it is infeasible to avoid such routing, construction activities should be scheduled (insofar as practicable) to occur during periods of reduced public use (October-May).

Coordination of project design and implementation with Federal, State, and local agencies is essential. The US Department of Housing and Urban Development; the US Department of Health, Education, and Welfare; the US Department of Commerce; SEMCOG; Wayne and Oakland Counties; the City of Detroit; and local municipalities should be active participants in the decision-making process for the HVWWCS. Especial attention should be given to secondary growth issues which are pivotal to future human needs and environmental quality in the Southeast Michigan Region.

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